Climate Disinformation Interventions: Negotiating Legitimacy in a Fractured Epistemological Landscape

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Abstract

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Climate disinformation poses an increasingly pressing problem, which obstructs public understanding of climate science and collective policy decision making. But research about solutions to climate disinformation is still relatively scarce. This dissertation approaches the problem of climate disinformation as a confluence of social, political, and technological forces that contribute to fractured public consensus on what counts as credible knowledge and who has the legitimacy to produce and represent public knowledge. By focusing on cases of tech-driven disinformation interventions built by various social actors, this research identifies three distinct approaches: scientist-led fact-checking (Climate Central and Climate Feedback), tech entrepreneur-led media literacy (AllSides), and digital platform self-regulation (Facebook). I use in-depth, semi-structured interviews, discourse analysis, and ethnography of infrastructure to examine the processes through which these actors employ legitimizing strategies and leverage technology and discusses the implications of these processes on challenges and opportunities for

professional journalism. The findings suggest that the issue of legitimacy is central for producing and representing public knowledge about climate change. For actors vying to shape public discourse about climate change, their legitimacy is shaped by distinct cultural ways of knowing and it is constantly contested, negotiated, and adapted to shifting social, political, and technological contexts of climate communication. These diverse epistemological frameworks of negotiating legitimacy provide insights for understanding the shifting dynamics of climate communication, epistemological challenges to repair fractured public consensus on climate change, and potential pathways for addressing climate disinformation. The findings highlight the vital role of journalism in bridging gap between scientific knowledge and public understanding of climate change, exposing fossil-fuel propaganda, and connecting social and environmental justice to the climate crisis. Ultimately, I suggest that effective interventions to climate disinformation requires reimagining institutional arrangements with communities of science, technology, and journalism that incorporate diverse and culturally specific epistemological frameworks.

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Chapter 1. Introduction

The Problem of Climate Disinformation

In August 2020, in the midst of the COVID-19 global pandemic, the West Coast of the U.S. was experiencing numerous severe wildfires. Lightning strikes combined with dry condition and warm temperature ignited numerous blazes, burning millions of acres across California, Oregon, and Washington, devastating rural towns, and filling the air of urban cities with thick hazardous smoke, in some cases, hundreds of miles from the blaze. While local law enforcement agencies were fighting the raging fires, they were also fighting rampant misinformation spreading on social media platforms and right-wing websites. Particularly damaging was one rumor that the left-wing Antifa groups were responsible for setting the fires, which circulated on Facebook after the Portland police warned Black Lives Matter protesters there to "demonstrate peacefully and without the use of fire" due to increased risk (Portland Police, 2020). Right-wing groups and politicians ran with the rumor sharing accusations among numerous local Facebook pages and groups. The rumors surged when Paul J. Romero, a former Republican candidate for Senate from Oregon, tweeted:

> "Oregon is on fire! Pallet Company in Oregon City confirmed Antifa arsonist on camera. Douglas County Sheriff has 6 ANTIFA arsonists in custody. Many fires in Oregon. Obviously there are more to track down and arrest."[1]

The tweet was shared more than 10,000 times and got reposted on Facebook, where it reached up to 680,000 people, mostly associated with far-right conspiracy group QAnon (Conger, Alba, & Baker, 2020). The misinformation was so pervasive that several local police

[1] Paul J. Romero has changed his X (formerly known as twitter) account name. The original tweet can be found at: https://x.com/PJR4Oregon/status/1303592773715546114

departments had to spend resources responding to public inquiries regarding the viral false claim. Among others, the Douglas County Sheriff's Office put on an announcement on Facebook pleading the pubic to stop spreading false information:

> "Rumors spread just like wildfire and now our 9-1-1 dispatchers and professional staff are being overrun with requests for information and inquiries on an UNTRUE rumor that 6 Antifa members have been arrested for setting fires in DOUGLAS COUNTY, OREGON. THIS IS NOT TRUE!" (Douglas County Sheriff's Office, 2020)

This was apparently not an isolated case. Later, the FBI's Portland office also tweeted that reports about "extremists" setting wildfires in Oregon are untrue (FBI Portland, 2020). In an era when people have grown accustomed to rampant political disinformation driven by right-wing political leaders as a convenient tool for manipulating public opinion, the case of the wildfire disinformation highlights the intensity and impact of climate disinformation in part due to the contemporary media infrastructures.

In the case of the West Coast wildfires, multiple social and political actors were behind the production, spread, and amplification of false information. Shortly after the false claim went viral on Twitter, right -wing media outlets joined in. On September 13th, 2020, *The Daily Caller,* right-wing news website and Facebook fact-checking partner, published an article claiming that former President Bill Clinton's liberal policies of forest management "paved the way for future debilitating wildfires" (White, 2020). The article was widely circulated on social media and appeared in multiple news media outlets. In response to widespread disinformation, those concerned with its corrosive impact on public discourse are devising various approaches to address the issue. Climate Feedback, for instance, a scientist-led nonprofit dedicated to fact-checking media coverage and claims about climate change, debunked the article by *The Daily*

Caller. Using crowdsourced reviews from scientists, Climate Feedback annotated the article, highlighting inaccurate claims and inserting scientific explanations. In the report published on the Climate Feedback website, the scientist reviewers also rated the overall scientific credibility of the article as "low" and tagged it with labels such as "biased", "clickbait headline", and "misleading" (Climate Feedback, 2020). The intervention of Climate Feedback triggered some changes: *The Daily Caller* later added a section of "correction" in the article, including the argument that climate change plays a role in driving the severity of wildfires.

The efforts of Climate Feedback to correct misleading information about climate change underscores a problem that is a confluence of social, political, and technological forces. These forces together create circumstances for a single misconceived tweet to quickly escalate to a public emergency event involving social media users, the police departments, professional journalists, scientists, and nonprofit organizations. These social actors, in this case, are playing their respective roles in a dysfunctional information environment. In an idealized scenario of a democratic society, scientists are trusted authorities providing objective and impartial scientific facts. Journalists, likewise, are credible arbiters of truth, informing the public with unbiased and nonpartisan information. Activists and advocacy groups work closely with scientists and journalists to raise awareness of social issues and promote policy changes.

This idealized scenario does not apply to the reality of climate communication in the past few decades. Instead, public understanding of climate science and government policies are heavily influenced by rampant disinformation campaigns funded by the fossil fuel industry, conservative think tanks and right-wing politicians aligned with them (McCright & Dunlap, 2011). For corrective efforts like Climate Feedback to effectively counter disinformation, it is crucial to identify, understand, and navigate through forces that enabled the dysfunctional

information environment. In this case, these forces include the strategic distortion of scientific facts by the right-wing politicians, political organizations and media outlets, the polarized political environment stoking up partisan emotions, the abstract nature of climate science complicating public communication, and the metrics and algorithmic logics of a networked media system privileging and amplifying certain information over others.

These social, political, and technological forces are situated in larger institutional arrangements that enable the epistemic discrepancy between public understanding and scientific facts about climate change (Farrell et al., 2019). Despite scientific consensus and overwhelming real-life evidence, climate change remains one of the most divisive social issues across Western democratic societies (Pew Research Center, 2020). As one of the central ways for individuals and groups to understand and make decisions about climate change, professional journalists play a crucial role in shaping the public discourse about climate change. However, the information environment surrounding climate journalism is rapidly shifting, as widely used digital platforms disrupt the hierarchies of public communication and weaken traditional gatekeeping role of journalists. Meanwhile, persisting news values in journalistic practices often impede journalistic efforts of effectively informing the public about the climate crisis (Brüggemann & Engesser, 2017).

Over the years, researchers have recognized that increased scientific knowledge and quality information does not necessarily drive changes in public attitudes, actions, and policies, especially when efforts distorting climate science and misleading the public is intentional and coordinated (Boykoff, 2019; Callison, 2014; Russell, 2023). Indeed, well-funded fossil fuel operatives intentionally manufacture and disseminate falsehoods about climate change, obfuscating informed public discussion and hindering public efforts to address the climate crisis.

Research has shown deeply connected organizational networks of fossil fuel interests obstructing public understanding of the climate crisis and stalling science-based policy solutions (Farrell, 2016; Farrell et al., 2019; Slevin, Kattrup, & Roberts, 2023).

Manufacturing deliberately false information is certainly not an invention of the fossil fuel industry. Disinformation has deeper roots in the history of American public discourse. The past fifty years has seen a long list of institutions and actors distorting public discourse and misleading public debate: the tobacco industry, the Strategic Defense Initiative defenders, skeptics of acid rain and ozone hole, and most recently, the fossil fuel industry. These "merchants of doubt" have weaponized artificial controversies to discredit scientific discoveries at the expense of public health and safety (Oreskes & Conway, 2010). Through strategies including advertising, doubtful press releases, funding pseudo-scientific research, and exploiting legislative agenda, these "fact fighters" produce the appearance of uncertainty about issues, breeding ignorance on scientific knowledge to serve political and commercial interest of benefiting industries (Farrell et al., 2019; Oreskes & Conway, 2010). The study of ignorance, Agnotology, also indicates that ignorance is often deliberately produced, strategically maintained and distributed by mostly powerful actors with deliberate agenda to achieve certain purposes (Proctor, 2008).

The strategies deployed by the fossil fuel industry to cast doubt on climate science is not new in the sense that it follows the playbook of previous "merchants of doubt" to manufacture controversies around scientific discoveries. Rather, the unprecedented influence of organized climate disinformation campaign is a product of the media environment where technological changes and long-running power inequalities permeate the information infrastructures (Russell, 2023). In many ways, the problem of climate disinformation can be also seen as a manifestation

of shifting social, cultural, and technological forces situated in broader contexts of ongoing epistemic crisis in American democracy, including disrupted public sphere, polluted media information, undermined authorities and norms of democratic institutions (Benkler, et al., 2018; Bennet & Livingston, 2018; Bennett & Pfetsch, 2018; Phillips & Milner, 2021).

Habermas (1991) theorizes the concept of the public sphere as a social domain where public opinion is formed through informed civic deliberation. A critical feature of the public sphere is the media, which fosters informed citizenry and collective decision-making through ritualistic representation (Dahlgren, 2009). Anderson (1983) underscores how certain forms of communication bring about certain forms of imagined social collectives. Just as print journalism serves as the key medium for constructing social identities associated with nation state, the transition to a networked public sphere introduces new organizing dynamics for knowledge production and social actions (Benkler, 2006).

Networking technologies and infrastructures enable the emergence of decentralized information distribution and loosely coordinated collective actions (Benkler, 2006; Bennett & Segerberg, 2013). The networked publics constructed by networking technologies has reconstructed how news is created, disseminated, and consumed by disrupting traditional gatekeeping roles of journalists and transforming power dynamics in the information ecosystems. As legacy media and digital media logics interact, compete, and collaborate, new norms, practices, and organizational structures emerge and evolve, constructing “the hybrid media system” (Chadwick, 2017). In hybrid media systems, professional boundaries among journalists, politicians, and citizens are blurred, creating opportunities for non-elites to leverage technological affordances to amplify organizational power. Groups of citizen journalists and

activists benefit from accessible technological tools and networks to expand journalistic practices beyond boundaries of traditional newsrooms (Russell, 2016).

Though early Internet research commends the democratizing potential of networking technologies in facilitating new ways of building social connections, there has been growing concerns about how networked information infrastructure can also be employed in deceptive media practices such as targeted advertising, propaganda, bots, trolls, and falsehoods (Chadwick, 2017; Marwick& Lewis, 2017). Privately owned and profit driven digital platforms have become the de facto information infrastructure, the invisible yet monopolistic scaffolding of social connection and information exchange in modern societies (Plantin et al., 2018). Algorithms, the emblematic feature of the digital platforms, highlights how the fabrics of the contemporary publics are being reconstructed by the shifting information infrastructures. Algorithms dictate the flow of information, privilege certain content over others, and shape the representation of the publics (Gillespie, 2014). Earlier studies indicate the algorithmic sorting and classification systems enable segregated publics of "filter bubble" and "echo chamber" of like-minded individuals and groups fractured by self-reinforcing beliefs and opinions (Pariser, 2011; Sunstein, 2017).

Subsequent research has contested the idea that the high-choice networked information environment facilitates audience fragmentation and partisan segregation (Dubois & Blank, 2018; Fletcher & Nielsen, 2018; Nechushtai & Lewis, 2019). Rather, research suggests that algorithmic recommendation systems tend to foster an uneven playing field where the designs and workings of these systems remains opaque to the users (Helberger et al., 2018; Pasquale, 2015). Therefore, algorithmic amplification makes it easier for deceptive information to reinforce false narratives

among unwitting participants (Starbird, 2019) and build illusionary social support of dubious worldviews among susceptible audiences (Shin et al., 2022).

As algorithmic decisions increasingly weave into technical and commercial arrangements of platforms, designers, engineers, and executives in the tech industry make value-laden editorial decisions through algorithmic recommendation systems (Diakopoulos, 2019). Platform metrics magnifying user engagement and viral contents increasingly constitute a prominent part of larger sociotechnical infrastructures (Bucher, 2018; Gerlitz & Helmond, 2013; Gillespie, 2017). Meanwhile, the ability to collect and analyze a vast amount of user data bestows monopolistic power on tech giants owning digital platforms like Facebook and Google in shaping public agenda (Pasquale, 2017). The imperative of maximizing profits drives digital platforms to promote attention-grabbing contents using algorithmic recommendations and rankings, providing ample opportunities for well-funded and coordinated conspiracy theorists and far-right groups to manipulate the public discourse (Marwick & Lewis, 2017).

The rise of digitally enabled disinformation is not a glitch in an otherwise well-functioning system. Rather, it is a symptom to larger dysfunctional political structures and information systems (Benkler et al, 2018; Bennett & Livingston, 2018). The systematic disruption of democratic institutional norms has been decades-long strategic endeavors by conservative politicians, think tanks, and advocacy groups to distort factual claims and shape political policies in favor of corporate and elite interests (Bennett & Kneuer, 2024; Bennett & Livingston, 2020). Indeed, research has documented concerning trends of dwindling civic engagement, eroding confidence in democratic institutions, and declined dedication to liberal democratic values in North America and Western Europe (Mair, 2013; Pharr, Putnam, & Dalton, 2000; Scarrow & Gezgor, 2010; Skocpol, 2003). The systematic attack on institutional

authorities and strategic distortion of facts have contributed to a "democratic deconsolidation", which threatens the legitimacy of democracy as the only widely accepted form of governance (Foa & Mounk, 2016).

The decline of civic institutions, breakdown of information system, erosion of shared democratic values, and growing dominance of algorithmic predictive power, together constitute the apparatus of "post-truth" politics (Harsin, 2015; Suiter, 2016; Waisbord, 2018a). In a post-truth society, shared normative assumptions of public deliberation and the mechanism of discerning and correcting false claims cease to be in action (Bimber & Gil de Zúñiga, 2020). As the traditional key truth-telling apparatus, professional journalism is plagued by the "epistemic rift", the rupture of common consensus on what constitutes as facts and who has the legitimacy to represent public knowledge (Russell, 2023). At the fundamental level, post-truth politics introduces contesting truth claims in collective sense-making, jeopardizing the normative vision of journalism in informing and connecting democratic publics guided by principles of rationality and reasoning (Waisbord, 2018b). While professional journalists used to be entitled with the authority to delineate public discourse with functioning democratic institutions, high level of public trust, and shared social values, the post-truth politics breeds lasting and coordinated distortion of facts and misrepresented values from right-wing media and political interests, rendering professional journalists vulnerable to the right-wing onslaught and constant pressure to defend their role as the arbiter of information in the public discourse.

Scholars have been concerned about the vulnerabilities of professional journalism and attempted to explain the causes from various perspectives (Pickard, 2019; Waisbord, 2019; Zelizer, 2015). A widely documented cause is the recent economic and technological disruption to the ecology of news production and distribution. The rise of digital platforms has largely

overturned the traditional advertising revenue model that commercial journalism has been dependent on for decades, leading to massive layoffs, precarious journalistic labor, and growing "news deserts" where local news rapidly diminishes (Abernathy, 2020; Pickard, 2019; Waisbord, 2019). As tech companies such as Google and Facebook profit considerably from targeted advertising through increasing news consumption on their platforms, journalists are forced to adapt to the new dynamics in the information environment, increasingly dependent on platforms for content distribution (Nielsen & Ganter, 2022). More recently, journalists are also relying on generative AI tools provided by platforms for content production (Simon, 2024). As newmaking continuously integrates with the platform infrastructures and platforms accrues more power in shaping the rules of the "virality game" in the attention economy, journalists become unwilling participants in an information system that unsettles their own institution and practices (Russell, 2023).

But the vulnerabilities of professional journalism in the digital age cannot be simply explained by technological disruption and cultural shifts alone. As Pickard (2020) argues, the root cause of American journalism crisis lies in structural failures of the commercial media system. The democratic prerogatives of journalism, including holding power accountable and facilitating policy deliberation across social spectrum are against the financial imperative of commodifying news. Media monopolies, lack of high-quality information, and marginalization of independent media are symptoms of the unregulated and highly commercialized media system, the core cause of the "misinformation society" (Pickard, 2017). Indeed, the need to negotiate inherent tension between serving public interest and abiding with market-driven logic in the commercial media system gives rise to journalistic professionalism, the endeavor of asserting autonomy and authority in representing public knowledge (Pickard, 2019).

The central pillar of journalistic professionalism is objectivity, a professional norm dominating American journalism for decades (Schudson, 2001). The objectivity norm guides journalists to separate facts from value and report social issues in impartial and balanced approach (Schudson, 1978). As a "strategic ritual" for journalists to defend professional legitimacy (Tuchman, 1972), objectivity norm has also bolstered journalists' occupational authority in making knowledge claims (Schudson & Anderson, 2020). However, there has been a reckoning with objectivity norm among newsmakers and researchers who pointed out the limitations and inherent bias of the objectivity norm over the years. For instance, the overdependence on official and elite sources has made journalists the megaphone for authorities (Bennett, 1983). Conforming to ideological frames of government authorities and the ruling elite class also impose a unified and hegemonic world view that translates to the appearance of political consensus of the society (Gitlin, 2003; Hallin, 1986). Under the guidance of objectivity norm, professional journalistic routines are established to maintain the legitimate parameters of public discourse; while ideological deviations or anomalies outside of the seeming consensus are deemed not newsworthy or failing the standard of objectivity (Reese, 1990).

The objectivity norm of professional journalism also plays out in climate disinformation, as fossil fuel funded agents exploit structural vulnerabilities of mainstream media to amplify their intentionally manufactured false messaging. In the United States, special interest actors such as Big Tobacco and Big Oil unscrupulously distorting scientific facts have a winning record of manipulating professional journalists to cover manufactured controversies as legitimate scientific debates in the name of balanced reporting (Oreskes & Conway, 2010). Additionally, deregulation of media ownership in the 1970s facilitated the rise of right-wing media, who routinely attack the "left-wing bias" of mainstream media (Bennett & Livingston, 2018). The

professional norm of objectivity and balance dictate journalists to present “both sides” of the story, even though it presents false dichotomy by giving undue legitimacy to climate denial as a valid counterpoint to scientific consensus (Boykoff & Boykoff, 2004). More importantly, the journalistic drive to maintain “the appearance of debate” also lends opportunities for fossil fuel interests backed climate denial, skepticism, and disinformation to manipulate the mediascape (Russell, 2023).

The journalistic failure of serving as a bulwark against propaganda and disinformation reveals the flaws of the traditional “marketplace of ideas” approach, assuming that the best quality information will rise on top in open and free democratic public discourse. In climate communication, especially, the belief in the “information deficit model” persists among scientists and journalists, emphasizing the importance of having increased and better scientific information in prompting altered public attitudes and behaviors towards addressing the climate crisis (Priest, 2016; Boykoff, 2019). However, the vast success of fossil fuel-funded disinformation campaigns in distorting the public understanding of the climate crisis challenges underlying assumptions associated with information deficit approach and long-lasting objectivity norm in scientific communication. As Callison (2014) convincingly argues, maintaining professional detachment, the ideal stance in scientific and journalistic communities and advocating for climate policy changes on behalf of the public, the commitment to democratic governance, are inherently conflicting goals in practices.

In fact, adherence to false balance does not just make journalists complacent in amplifying right-wing propaganda, obstructing public understanding of the climate science, and delaying collective actions to address the climate crisis. The “view from nowhere” news also legitimizes the market logic of the commercial media system, which prioritizes monopolizing

commercial profits benefiting the fossil fuel industry, Wall Street, and Silicon Valley over the safety and health of individual citizens and social communities. As a part of the commercial media system, journalists often participate in perpetuating power inequality and dominant social order, which serves privileged elite interests at the cost of disconnecting and exploiting marginalized social groups (Callison & Young, 2019; Fenton et al., 2020). As Callison and Young (2020) argue, by asserting journalistic authority through reliance on official sources and commitment to the objectivity norm in climate reporting, legacy journalists continue to project white and masculine power while isolating and dismissing indigenous and underrepresented perspectives. Essentially, the fight for climate justice cannot be achieved without addressing the injustice and power imbalance in news media (Russell, 2023).

Recognizing the problem of climate disinformation is a confluence of multifaceted social, political, and cultural forces is the first step to address the problem. Increasingly, scientists, NGOs, entrepreneurs, and journalists are building practices attempting to address the problem using a myriad of approaches. Their efforts are inevitably grounded in various perceptions of how the problem originates and what potential remedies are best positioned to address the epistemological challenges of fractured social and political consensus. In the following section, I examine three prevalent approaches in addressing climate disinformation, including institutional fact-checking, media literacy, and platform regulation.

Approaches to Address Climate Disinformation

Although there is increasing amount of research focusing on understanding the mechanisms of manufacturing and propagating climate disinformation, research on efforts to intervene and address climate disinformation is still relatively scarce. Current research on countering climate disinformation has mostly focused on the effectiveness of specific methods

such as inoculation, debunking, and long-term education (Lewandowsky, 2021). However, much as the problem of climate disinformation is grounded in social, political, and cultural sphere. The barriers of addressing climate disinformation are also contingent on divergent values and belief systems adopted by various social groups. As Hulme (2009) points out, individual disagreements about risks and solutions of climate change shaped by different values and interests related to identity, politics, and ethics, rather than merely science. This means evaluating the effectiveness of specific methods alone won't adequately address the problem of climate disinformation, as any effective intervention must consider distribution of power in the larger social and political landscape. As Russell (2023) contends, instead of taking individualistic approaches in addressing climate disinformation, we need to envision collective solutions that tackle epistemological challenges in our social arrangements with science, Big Tech and journalism. That is, it is necessary to reconsider the roles that scientists, digital platforms, and journalists serve in the society and organizational structures they operate in to create conditions for facilitating social trust and trustworthy information.

In this dissertation, I focus on three cases of different professionals—scientists, tech entrepreneurs, and digital platforms using three prevalent approaches of addressing climate disinformation: institutional fact-checking, media literacy, and platform regulation. For the institutional fact-checking approach, I examine the cases of Climate Feedback and Climate Central, two nonprofit organizations led by climate scientists dedicated to fact-checking climate information. For the media literacy approach, I examine the case of AllSides, a news startup built by technologists and entrepreneurs aiming at improving media literacy through an algorithmically aggregated media bias rating system. For the platform regulation approach, I

examine the case of Facebook, the largest social networking platform in the world, which has also been at the center of the public criticism of digital platforms over recent years.

The three approaches all attempt to address the core epistemological challenge in the post-truth political era: the lack of consensus on what constitutes facts and what institutional setting is best situated to generate and disseminate truthful information. The institutional fact-checking approach examines a holistic and multifaceted process that involves more than just debunking and correcting false claims. Rather, it underscores the institutionalized process of fact-checking, which entails professionalizing staff, contextual verification of information, and outreach efforts to promote fact-based information in the public discourse. The media literacy approach focuses on not just educating the public about rapidly shifting ecology of information system, but also on re-evaluating and reconstructing social agreements on trustworthiness of sources and institutions producing public information. The platform regulation approach centers on the content moderation mechanism, which uses algorithms and human labor to flag, reduce, and remove false and misleading user content based on platform community standards. Rather than treating climate disinformation as a singular scientific communication issue, all three approaches take into account the broader social, political, and cultural contexts in which disinformation is manufactured, disseminated, and amplified.

Fact-checking has historical roots in professional journalism (Graves, 2016). Initially, fact-checkers were conducted by newsrooms to strengthen accuracy of reporting. For major political fact-checker such as Politifact.com and FactCheck.org, the primary drive is journalistic: to restore the legitimacy and credibility of professional gatekeeping (Graves, Nyhan, & Reifler, 2016). In their practices, fact-checkers abide by traditional journalistic commitments such as fairness, nonpartisanship, and transparency. On the other hand, professional journalists also see

fact-checking practices of assessing veracity of public claims as an endeavor to maintain the core values and principles of journalism (Mena, 2019). In many ways, the fact-checking movement can be seen as a reform effort to revitalize established professional norms and values of journalism besieged by disinformation (Graves, 2016).

But the fact-checking intervention can be more than just a reform endeavor to restore the core professional values of journalism. Rather than being a sub-community of the journalistic enterprises, independent fact-checking organizations are on the rise and establishing legitimacy in the public discourse (Lowrey, 2017). Fact-checkers now are not only the ones affiliated with legacy media, but also entrepreneurs who operates stand-alone practices unaffiliated with media organizations (Singer, 2018). As professional fact-checking steadily growing into a global movement, shared beliefs, norms, standards of practices, and governing mechanisms are evident among fact-checking practices, indicating collectively constructed culture and institutionalized development (Graves & Lauer, 2020; Koliska & Roberts, 2024; Lowrey, 2017).

At the same time, the boundaries of the fact-checking field have been extended, revealing a more heterogeneous space with divergent mission and focuses (Graves, 2018; Graves & Mantzarlis, 2020). Fact-checkers comprise actors from a wide range of professional backgrounds, including NGOs, entrepreneurs, civil and advocacy actors (Graves, 2018; Graves & Mantzarlis, 2020; Singer, 2018). These actors also have various funding sources, affiliations, and institutional logics (Kim & Buzzelli, 2022; Singer, 2018). Fact-checkers now view their profession as positioned to both extend the traditional journalistic practices and address the shortcomings of traditional journalism (Singer, 2018; Singer, 2021). For many civic oriented fact-checking organizations, fact-checking can potentially strengthen democratic institutions and

serve public interests by holding political entities accountable and providing resources for social and political policy making (Amazeen, 2020; Singer, 2021).

As governments and private interests continue investing in fact-checking operations as a potential solution to disinformation, the effectiveness of fact-checking remains contested among researchers. Although fact-checking can increase accuracy of reporting and positively affect overall beliefs through reinforcing facts, individual pre-existing knowledge and ideologies significantly limit the corrective impact (Nieminen & Rapeli, 2019; Walter et al., 2020; Wood & Porter, 2019). Indeed, as Vinhas and Bastos (2022) argue, fact-checking that operates merely as debunking and verifying ephemeral factual versus non-factual information alone does not likely suffice to fulfill the "consensus building" promise. Instead, the study of fact-checking should adopt an institutional approach, which looks at norms, rules, and procedural standards of the fact-checking practices. Examining norms, routines, and institutional logics as ways of knowledge production helps us better understand the "epistemic core" of fact-checking (Koliska & Roberts, 2024, p. 10).

As a popular intervention to disinformation, fact-checking practices have recently started to incorporate other initiatives such as media literacy (Çömlekçi, 2022). Traditionally, media literacy education focuses on improving individual's critical ability to discern facts from false information (Flynn, Nyhan, & Reifler, 2017). The media literacy approach assumes that by equipping individuals with better knowledge about the media production process and the ability to critically consume media messages, individuals are more likely to effectively navigate through the information environment and engage in democratic politics (Buckingham, 2003; Mihailidis & Thevenin, 2013).

Previous research has shown that media literacy education facilitates young people's civic engagement (Hobbs et al., 2013; Kahne & Bowyer, 2019; Swart, 2023), increases skepticism of conspiracy theories (Ashley et al., 2017), and bolsters accuracy in identifying fake news (Jones-Jang et al., 2021; Kahne & Bowyer, 2017). Media literacy intervention can be a potential solution to the disinformation crisis we are facing today, as it fits into the prevalent narrative that an ill-informed public is somewhat responsible for the proliferation of disinformation. But researchers argue that seeing media literacy as a "cure" to disinformation oversimplifies the problem (Mihailidis & Viotty, 2017).

More recent research has pointed to the limitations of traditional media literacy intervention. For instance, digital media literacy intervention has mostly focused on children and youth, while overlooking adults and nondigital natives (Lee, 2018). More prominently, traditional media literacy intervention often places the responsibility of identifying and verifying disinformation on individuals (Bulger & Davison, 2018). In the networked information environment, multi-layered barriers pose challenges for individual users to discern false information and trace sources. While professional journalists lose centrality in gatekeeping public information, individuals are actively engaging with diverse social networks to reaffirm their preexisting views, relying mostly on confirmatory and relevant information rather than facts (Sundar, 2016). The lack of transparency in the mechanism of algorithm further limits the individual access and capacity to critically examine information presented on ubiquitous social media platforms (Bulger & Davison, 2018). The focus on individual skill attainment in media literacy approach falls short to account for the epistemic complexities of post-truth political contexts that disinformation situates (Mihailidis & Viotty, 2017).

Instead, researchers argue that media literacy intervention should be repositioned in a hybrid and complex information ecosystem and provides a more systematic mapping of interactions among multiple actors such as state, technology companies, and media institutions (Bulger & Davison, 2018). Similarly, more recent research on social media literacy among youth indicates that media literacy is not individually transferrable skills, but socially situated, connective and adaptable knowledge (Swart, 2023). Indeed, effective intervention of disinformation needs to examine the "social ingredients" that enable the information system to foster a culture that values truth and enables citizens to engage "meaningfully and substantively" (boyd, 2017; Lazer, et al., 2017). Therefore, for the media literacy approach to be an effective intervention of disinformation, it needs to move beyond the individualistic focus and adopt a more relational approach that facilitates participation and community building among multiple social political and cultural sectors (Mihailidis & Viotty, 2017). Research on media literacy intervention should also reorient its focus towards efforts that aim to help individuals understand the broader social, economic, and political contexts in which media messages are being constructed.

Media literacy intervention increasingly highlights digital media literacy and recognizes the role digital platforms play in shaping public discourse. At the same time, another emerging approach to address disinformation targets the regulation of digital platforms. In 2018, the Cambridge Analytica scandal has revealed that the political consulting firm improperly harvested data from millions of Facebook profiles without users' consent. Data was used to create psychological profiles for targeted political ads in the 2016 U.S. Presidential Election without informed consent, fueling outrage over how Facebook handled user privacy. Facebook was under increasing public pressure for its failure in safeguarding user privacy from exploitation of third-

party actors. Over the years, substantial public attention on digital platform accountability also facilitates growing academic research examining platform accountability. Growing research suggests that digital platforms are serving as active agents in influencing political campaigns, governing information flows, and setting norms for the public discourse (Gillespie, 2018; Kreiss & Mcgregor, 2018).

Public scrutiny over the growing influence of platforms, especially regarding their monopolistic practices, data privacy, and political disinformation has galvanized public support of the Biden Administration's regulatory agenda. The appointment of Lina Khan, a prominent anti-trust legal scholar as the Chair of the Federal Trade Commission (FTC) epitomizes the Biden Administration's response to the public and legislative demand for accountability of Big Tech. However, legislative efforts to regulate platforms face multiple challenges. In the U.S., Section 230 of the Communications Decency Act grants legal immunity to platform operators to be held accountable for content published by users on their platforms. In addition, government regulations are usually slow and inefficient. Regulating multinational cooperates beyond national borders is often difficult for single nation state governments. There are also discrepancies in people's understanding of what role government should play in intervening public discourse around the world (Beridzishvili, 2020; Epstein, 2020). More importantly, the transition to Trump presidency inevitably shifts the regulatory environment towards deregulation, likely upending the Biden administration's previous efforts of proactive intervention to reining in monopolistic power of Big Tech.

When facing regulatory pressure, digital platforms such as Facebook tend to frame themselves as neutral carriers of political messages in the public narratives, sidestepping accountabilities of algorithm-generated misinformation and social vulnerabilities (Russell &

Clark, 2018). Platforms often defend their role in proliferating disinformation for profit-making and lack of action in moderating harmful content by employing discursive frames such as "neutral technology", "free expression", and "vibrant community" (Gillespie, 2018, p. 49). Tech companies also tend to frame their algorithms used for content ranking and classification as objective mechanisms that operate independently and strategically characterize "platforms" as neutral intermediary free of human intervention and value judgments (Gillespie, 2010). Besides discursive measures, influential digital platforms also employ a set of self-regulatory measures to moderate user generated contents. These commonly used moderation strategies include editorial review, community flagging, automated detection (Gillespie, 2018). Most digital platforms employ commercial moderation model, which combines algorithm-driven moderation and professional human moderators (Seering, et al., 2019).

These content moderation mechanisms have already drawn scholarly critique in the past. One area of criticism focuses on labor concerns, as most human moderators employed are outsourced contractors from underdeveloped countries with low-status and low-wage (Roberts, 2019). More criticism, however, focuses on the lack of transparency in the moderation process in which rules and methods are inaccessible to public oversight (Gillespie, 2018; Suzor, 2019). The concern of opacity is especially related to the increasing adoption of algorithmic and AI-based moderation, which further aggravates existing issues with platform content policies in terms of transparency, fairness, and depoliticization (Gorwa, Binns, & Katzenbach, 2020).

These existing problems with platform content moderation mechanisms are further complicated by the shifts of political contexts and accompanying changes to the regulatory policy environment. Under the Trump presidency, the regulatory environment shifts to laissez-faire style deregulatory governance. With agencies like FTC scale back from posing legal

challenges to tech companies' data practices, business model, and public accountability, tech giants such as Facebook are already taking steps to shift content moderation policies. In January 2025, prior to another term of Trump presidency, in a likely attempt to woo the incoming administration, Mark Zuckerberg, CEO of Facebook's parent company Meta announced that the company was ending its third-party fact-checking program in the United States (Isaac & Schleifer, 2025). Instead, the tech giant is transitioning content moderation model to "Community Notes", resembling the crowdsourced feature of Elon Musk owned platform X (Kaplan, 2025).

Facebook launched its third-party fact-checking program in 2016, amid ensuing regulatory pressure for unchecked disinformation circulating on its platform that contributed to Trump's election. The adoption of voluntary regulatory measures like the third-party fact-checking partnerships reflected a more proactive and confrontational regulatory approach of the Biden administration. The termination of voluntary self-regulatory measures in turn indicates tech companies' ideological pivot to align content policies with the political priorities of the Trump Administration. The combination of weakened federal regulation and market pressure for self-policing may lead to platforms relying on self-regulation as the only approach to maintain legitimacy. But Facebook's changes in content moderation policies raise questions about platform self-regulatory measures as a reliable mechanism combating climate disinformation. These policy decisions are almost always shaped by political expediency, shifting with the prevailing political whims of the moment.

Examining platform self-regulatory measures, especially the narrative patterns of how platforms frame and situate these measures as interventions to disinformation, provides a window for understanding the often-opaque platform mechanism that facilitates the production

and dissemination of disinformation. As governments and tech companies continue to invest heavily on automated systems and AI technologies to be integrated into multiple aspects of social and political life, a critical inquiry into the discursive framing of platform enacted content regulatory measures also helps us reflect on cultural assumptions about what public contents should be allowed and who has the power to make decisions of political and social importance.

Despite distinct focuses and priorities behind these three approaches, the actors who build practices attempting to address climate disinformation all place technology at the forefront of their practices: they see digital technology as either an essential tool built into organizational routines, or as the root cause of climate disinformation tied to institutional logics shaping their practices. They also share the view that technology must be a central part of the solution. For these scientists, tech entrepreneurs, and tech companies, addressing disinformation requires deep understanding of technological designs and structures that enable them to navigate through the post-truth information environment and counter well-coordinated disinformation campaigns. Examining these tech-driven approaches provides us an opportunity to reconsider how scientific institutions, tech companies, and news media are adapting to the shifting political, social, and cultural conditions. Through examining norms, values, and cultural assumptions of these practices, we can better understand what institutional arrangements of science, technology, and journalism are best suited to address the systemic problem of climate disinformation.

These interventions are also responses to the core challenge of climate communication, the epistemological rupture in the post-truth political communication: disagreements about what constitutes truth and who has the authority to represent trustworthy public knowledge. The three intervention approaches, institutional fact-checking, media literacy, and platform regulation can all be considered as traditional “outsider” efforts of shaping the boundaries of public discourse

about the climate crisis. Traditionally, professional news organizations make judgements about what is newsworthy and what gets on the public agenda. The legitimacy and authority of serving as the gatekeeper of public information are bestowed on professional journalists. Networking technologies and tools allow these traditional "outsiders" to engage in public agenda shaping practices traditionally exclusive to the newsroom. In these practices, scientists, entrepreneurs, and tech platforms collaborate with journalists to produce and disseminate scientific information about climate change. At the same time, these outsider actors also compete with journalists to attain the legitimacy to shape public discourse about climate change.

Addressing Climate Disinformation as Boundary Work

Who gets to shape the public discourse about climate change? The question underlies the foundation of building potential solutions to address climate disinformation. When scientists, entrepreneurs, and tech companies build their practices to tackle climate disinformation, they are engaging in "boundary work" (Gieryn, 1983), the attempts to demarcate between their practices and other rivalry professionals. Social boundaries are often seen as markers of social differences in distribution of access, resources, and power in a variety of social systems (Lamont & Molnár, 2002). The construction of social boundaries highlights both the distinctions among social entities and the social apparatus that upholds and legitimizes the demarcation (Carlson, 2015a; Carlson & Lewis, 2020).

According to Gieryn (1999), boundary work has been a constant part of the institution of science in its efforts of legitimizing, defending, and maintaining its place in the larger system of knowledge production. The goal of boundary work is to locate "epistemic authority", the legitimate power to privilege certain epistemologies as "distinctively superior ways of knowing" (p. 2). Similarly, Abbott (1988) highlights how professionals distinguish from one another

through “interprofessional competition” for exclusive “jurisdictional control” in shared social ecological systems. The goal of social professions in organizational development is to attain monopolistic jurisdiction over these disputes, namely, establish exclusive social and cultural control. For social actors vying to shape public discourse about climate change, the goal is to contend for control and influence in projecting their epistemological perspectives into public understanding of climate change.

Although Gieryn (1983, 1999) focuses largely on the boundary work of scientists in establishing legitimacy of the institution of science, scientists certainly are not the only professionals engaging in boundary work. Scholarship in journalism research has also been interested in how professional journalists distinguish their profession as a legitimate form of public knowledge production and cultural practice (Carlson, 2015a; Carlson, 2016; Carlson & Lewis, 2020). In fact, any social actors seeking jurisdiction over certain social domain all engage in boundary work to define what they do and justify how they do it. The framework of boundary work is especially applicable for climate communication as science and journalism are both facing constant political and social contestation in the context of post-truth political communication.

Whether it is “jurisdictional contests” among professions, or competitions for “epistemic authority”, both Abbott (1988) Gieryn (1999) highlight the “perpetually contested” struggles to locate legitimacy and authority of making knowledge claims in various social domains. Establishing legitimacy is a primary professional goal for any social groups attempting to distinguish their practices from competitors in any contested social domain. The issue of legitimacy is central in boundary work because it grants social acceptance and cultural authority

to winners of boundary disputes, which can translate to material rewards and power such as social prestige, career resources, and professional autonomy (Gieryn, 1983).

More specifically, the discursive justification of legitimacy is central in casting boundaries around science as legitimate and prioritized forms of knowledge production (Gieryn, 1999). Interpretive strategies are also crucial for journalists to defend journalism as a legitimate cultural practice. For journalists, collective discourses and shared interpretations of key events among interlocutors constitute the "interpretive community" of journalism (Zelizer,1993). For outsiders, the status of journalists as legitimate public knowledge producers is contingent on discursive construction of journalistic roles and identities in the society (Hanitzsch & Vos, 2017, p. 122). These roles and identities are reinforced through discursive justifications of institutional norms, values, and practices (Hanitzsch & Vos, 2018). In fact, for any social actors vying for legitimacy, it is necessary to discursively justify what they do and how they do it. Therefore, examining the discursive processes in which norms and values are being legitimized is a crucial step to understand these tech-driven practices.

Since legitimacy is a central concern for social actors engaging in boundary work, the framework of "civic epistemology" by Jasanoff (2005) provides broader cultural and institutional context in which boundary work operates. Civic epistemology highlights culturally specific ways that societies evaluate and legitimize knowledge practices in public decision making and social governance (more details in Chapter 2). Both frameworks highlight how societies determine what is legitimate knowledge, who has the authority to produce it, and how it is accepted in public decision-making. When competing social actors attempt to assert authority over knowledge claims in contentious domain, such as the climate discourse, pursuing and defending legitimacy of knowledge practices from other professional competitors in boundary work is

further shaped by societal expectations and cultural norms determine what knowledge practices is considered legitimate.

Although it is useful to think of boundaries as tools for demarcating social differences across professional institutions, boundaries can also serve as "means of communication" rather than division (Lamont & Molnár, 2002, p. 177). In fact, social boundaries are critical interface through which various communities communicate. Star and Griesemer (1989) conceptualize "boundary object" to describe how interfaces of boundaries facilitate coordination and cooperation among divergent actors in heterogeneous scientific work. Boundary objects, either "concrete or abstract", can adapt to and serve different needs of various communities but can also translate across them while maintaining coherence (Star & Griesemer, 1989, p. 393). The concept of boundary objects highlights the elements of communication and coordination in boundary work, as opposed to divisions and exclusions in boundary disputes (Lamont & Molnár, 2002).

In efforts to address climate disinformation, digital technology can be regarded as a boundary object that serve as a shared tool for communities of scientists, entrepreneurs, tech companies, and journalists to represent their knowledge and build their solution-based practices. According to Star (2010), one of the most prominent features of boundary objects is their "interpretive flexibility" that allows for different interpretations and usages across intersecting social worlds. Digital technology demonstrates interpretive flexibility that allows scientists, entrepreneurs, tech companies to have divergent views about what role digital technology plays in their efforts of addressing climate disinformation. Another aspect of boundary objects is that they are "weakly structured in common use" (Star & Griesemer, 1989, p. 393). The loosely arranged structure allows communities to cooperate without consensus (Star, 2010). As a tool,

digital technologies are loosely structured to fit in needs and concerns of different professional groups in their efforts of addressing climate disinformation. Whether it is algorithm driven system, or a digital media platform, digital technologies take flexible forms when being built into the design of these practices and allow for modifying usages and purposes under changing circumstances.

Another central property of boundary objects is the level of robustness that maintains the "coherence of translations" across communities (Star & Griesemer, 1989, p. 389). Different professional communities need to collectively recognize the importance of the boundary object and can be united by shared interests in its dissemination and use (Lewis & Usher, 2016). For scientists, tech entrepreneurs, and digital platforms, digital technology unites their efforts of addressing climate disinformation through consensus that it is necessary to incorporate technology as an essential part of the solution. In many scenarios, digital technologies like social media platforms, collaborative data tools effectively enable these actors to connect and work together towards the shared goal of shaping climate knowledge production and dissemination.

If the discursive struggles over of establishing legitimacy highlights professional distinctions among social actors, the narratives around how to situate digital technology in their practices accentuates the "common meeting points" (Carlson, 2015a, p.7) among different social groups. For communities of scientists, technologists, and journalists, digital technology constitutes such a connective meeting point in their collective concerns, visions, and solutions to address climate disinformation. In climate communication, it is often the ability to leverage technological opportunities that facilitates interaction and collaboration among heterogenous social groups (Russell et al., 2023).

Scientists, technologists, and journalists often operate in distinct social worlds with divergent goals, epistemologies, and institutional norms, but they rely on shared technologies such as digital platforms and data visualization tools to connect and collaborate. The concept of boundary objects highlights the common role of technology in shaping social actors' efforts to address climate disinformation. However, the dynamic processes of how these actors leverage digital technology to shape climate discourse can be better understood by adopting the mediation framework (Lievrouw, 2014). The mediation framework emphasizes the co-evolution of technology, practices, and social arrangements through three interrelated processes: reconfiguration of artifacts, remediation of practices, and reformation of arrangements (more details in Chapter 3). These processes highlight the nature of digital technology as not neutral and fixed objects but constant sites of negotiation of evolving norms, values, and power dynamics. Adopting the mediation framework illuminates the dynamic processes in which these actors leverage technology to navigate boundary negotiations, assert legitimacy, and influence public discourse.

Boundary work and boundary objects provide important conceptual tools to consider how different social actors such as scientists, technologists, and journalists come to delineate the contours of public discourse about climate change. Both concepts underline the tension of boundary maintenance among professional communities. However, in some sites where contestation or coordination occur, social boundaries are less rigid and are more easily challenged, shifted, and collapsed. Journalism, for example, operates in such contested space and it "remains a very permeable occupation" (Abbott, 1988, p. 225). The porous boundaries of journalism make boundary work particularly taxing for journalists as they lack the monopolistic power to defend their professional legitimacy as arbiters of truth.

The permeability of journalistic boundaries is further compounded by digital technologies (Carlson, 2015a; Carlson & Lewis, 2020). In the digital media era, the contested spaces where journalists continuously erect cultural boundaries are increasingly shaped by tension between journalistic professional control and participation of new actors (Lewis, 2012). Yet the blurred boundaries in contestations of shaping public discourse do not render journalism less important in climate communication. In fact, climate journalists are "key mediators" translating climate knowledge between the science community and the public sphere (Brüggemann & Engesser, 2014). Thus, boundary work provides an important lens for understanding how journalists define, defend, and negotiate their authority and professional legitimacy through professional norms, values, and practices in a rapidly shifting information environment. For example, journalists have traditionally relied on occupational norms such as objectivity as boundary markers to claim social authority (Schudson 1978). In the rapidly shifting information environment, new occupational norms such as independence, impartiality, and transparency become more prominent boundary devices protecting the legitimacy of journalists (Singer, 2015).

But boundary work not only illuminates journalistic efforts to establish and maintain boundaries to distinguish their profession from other forms of public communication. More importantly, it highlights the perpetually contested space in which journalists struggle for epistemic authority against competing social actors, such as scientists, tech entrepreneurs, and digital platforms. What we traditionally consider as journalism is this contested space shaped by boundary negotiations between journalists and emerging social actors. The decisions of expanding or excluding certain actors, norms, and practices are essentially boundary negotiations about authority and identity of professional journalism (Carlson, 2017).

To understand how journalism is shaped by boundary negotiations with various social actors, we need to understand evolving norms, values, and relationships brought by these negotiations. The theoretical lenses of hybridity (Chadwick, 2017; Hallin et al., 2023) and networked journalism (Russell, 2016) provide useful tools to examine these shifting norms, values, and practices. Hybridity highlights the interconnectedness and interaction of media logics; while networked journalism focuses on the decentralized, participatory, and collaborative forms of journalistic practices. Both hybridity and networked journalism highlight blurring boundaries among social actors, practices, and power dynamics (more details in Chapter 4).

Networking technologies enable decentralized and participatory forms of news making among groups of NGOs, citizen journalists, and activists (Russell, 2016). When new and old actors, news making practices, and media logics converge and collide, boundaries among various actors, practices, and organizational structures are constantly blurred, constructing "the hybrid media system" (Chadwick, 2017). The blurred boundaries among climate journalists, scientists, NGOs, and activists allow them to become co-producers of climate knowledge, blending different professional norms, values, and practices (Brüggemann& Lörcher, 2020; Lück et al., 2016). In these "co-productive" relationships, the competitions for legitimacy are also public competitions of defining what journalism is and what boundaries it should have.

Cases and Methodology

By looking at technology-driven practices addressing climate disinformation, this empirical study focuses on three cases: Climate Feedback and Climate Central, AllSides, and Facebook. These cases are also strategically selected because they represent three newly emerged and prevalent approaches for climate disinformation intervention: scientist-led institutional fact-

checking intervention, entrepreneur-led media literacy intervention, and tech company-led platform regulation.

While "small-N qualitative research" does not provide the generalizability across a wider population like statistical methods, it can serve to help further theoretical development (Ragin, 1992). Empirical case studies are particularly useful for studying newly emerging and fast-evolving social phenomena such as interventions to climate disinformation. The flexible design of case studies helps identify new patterns, themes, and power dynamics that do not fit neatly into existing theoretical models and provides a "developmental" view to account for how cases develop and evolve over time (Flyvbjerg, 2011).

The flexible, context-sensitive, and in-depth approaches of case studies provide unique advantages for my research goal of developing deep and contextual understanding of emerging cases of climate disinformation interventions. As Yin (2018) points out, case study is well suited for "how" and "why" questions. My research questions are both exploratory and explanatory: to understand what norms, values, cultural assumptions embedded in these practices and social, political, and how technological forces shaping these practices. First, case study provides a systematic and in-depth approach to develop descriptions that comprise rich details of "technically distinctive situations" (Yin, 2018, p. 15). Second, case study produces "context-dependent knowledge" as the cases unfold in real-life situations (Flyvbjerg, 2011). Instead of treating cases as isolated events and phenomena, the design of case study accommodates the complexities and contradictions in various perceptions of cause and stakes of climate disinformation, the motivations and priorities in building these practices.

Specifically, I use a multiple-case design that allows both "within-case analysis and cross-case comparisons" (George & Bennett, 2005, p. 18). As Satori (1991) stated, comparative method and case studies are "mutually reinforcing and complementary undertakings" (p. 252). While case studies establish the groundwork for theory building, cross-case comparison test theoretical expectations in different contexts, improving the external validity of theories and leading to more nuanced and adaptable theories. The commonalities shared by the three cases could potentially serve to lay foundation for generalizability of tech-driven interventions of climate disinformation. I use multiple sources of evidence in these cases for data triangulation. These sources include in-depth interviews with informants, direct observations, archives and documents analysis. According to Yin (2018), diverse sources of evidence strengthen the robustness of the research findings and help develop a well-rounded understanding of the research problem.

Data Collection

I collected a diverse array of data from multiple sources, including public documents, archives, interview transcripts, media reports, and digital artifacts from websites and social media platforms for each case. Public documents and archives include official reports, policy documents, historical records, and public announcements from these organizations. Interview transcripts collect insider perspectives and firsthand experiences from key informants. Media reports provide contextual information about how each case is being portrayed in the media discourse. Digital artifacts, such as website content, articles, textual and graphical features, and social media posts capture framing strategies, visual representations, and emerging narratives. Together, these diverse data sources contribute to building a rich and multifaceted dataset that enables a comprehensive and in-depth analysis of these cases.

For interviews, I conducted three in-depth semi-structured interviews with at least one key informant of Climate Feedback, Climate Central, and AllSides respectively. Informants are individuals who have valuable cultural knowledge to inform the researcher about the "scenes" of interest (Lindlof & Taylor, 2011, p.177). A good informant has the qualities of cultural sensitivity, accuracy, and competence to connect the research to the community (Gabor, 2017). I identify and select key informants who possess expertise and experience relevant to these cases. For Climate Central, I interviewed Peter Girard, VP for External Communications on December 3, 2021 (Girard was the Director of Communications at the time of the interview). For Climate Feedback, I interviewed Nikki Forrester, Science Editor, Climate, at Science Feedback (The parent organization of Climate Feedback) on June 24, 2021 (Forrester was listed as one of the former contributors as of September 2024). For AllSides, I interviewed Julie Mastrine, the Director of Marketing and Media Bias Ratings on May 14, 2021 (See Appendix A for interview recruitment information). Subsequently, I had email correspondence with the Co-founder and CEO of AllSides, John Gable, who provided clarifications to some questions I had in my interview with Julie Mastrine.

Due to the COVID-19 pandemic and logistic constraints, all three interviews were conducted via Zoom. Each interview lasted approximately 45 minutes. All interviews were recorded with participant consent. In these interviews, semi-structured interview guide was developed based on themes identified in the literature and prior knowledge with the cases. The interview guide focuses on four major aspects: (1) the organizational structures, routines, and major programs of their practices; (2) what they perceive to be the cause of climate disinformation and obstacles of addressing it; (3) how they situate technology in their practice;

and (4) examples of success and failures in their operations (See Appendix B for sample interview protocols).

For Facebook, however, I was not able to obtain interview access after multiple attempts of reaching the company. The website of Meta (parent company) does not provide specific contact information to the public for interview access. The company's efforts of offering research access are mostly focused on its API (Application Programming Interface), which allows content and data published and stored on its platforms to be accessible for researchers (Clegg, 2023). For my specific research questions, I need access to individual employees who have knowledge about designing and maintaining the content moderation mechanism. But my attempts to contact Facebook employees through private connections for potential interview access were declined as employees cited concerns about violating company privacy policies and protocols. Therefore, I focus on alternative types of data sources to study the case of Facebook. These sources include direct observations of websites, analysis of press releases, public documents, media reports about Facebook, and Mark Zuckerberg's official testimonies in front of US congressional committees.

The data collection process is informed by the methodological framework of "ethnography of infrastructure": studying infrastructure through the ethnographic lens (Star, 1999). Star (1999) argues that adopting a relational approach to infrastructure encourages bringing an "ethnographic sensibility" to the process of collecting and analyzing data (p. 383). The relational approach recognizes that meaning making is contingent on specific circumstances, and meanings are inscribed into the decisions of building information systems. The relational approach recognizes that meaning making is contingent on specific circumstances, and meanings are inscribed into the decisions and priorities of building infrastructural systems. Therefore,

ethnographic methods including semi-structured interviews, observations, and digital document analysis are suitable for examining the multifaceted sociotechnical infrastructures in these cases.

Infrastructures only become visible when they are being broken down and sociotechnical relationships are "inverted" (Bowker & Star, 1999). By collecting and analyzing a diverse array of data, the purpose is to provide an in-depth description of the cases including case history, contexts, routines, and highlighted events, and "invert" the relationships among people behind infrastructural systems and material objects embedded in these practices. In interviews, ethnographic observations, and document analysis, I investigate the "invisible work" behind infrastructures of tech-driven practices through formulating interview questions, analyzing documents, and observing online discourse. Specifically, I identify "master narratives", the unconscious dominant voice encoded into the infrastructure (Star, 1999), and contrasting hidden narratives that reveal how organizational routines are maintained, how standards and protocols are enforced, and how decisions about inclusion and exclusion are being made.

Data Analysis

The primary analytical approach is the grounded theory (Glaser & Strauss, 1967), the systematic and inductive approach to develop theoretical insights from data. Guided by Charmaz's (2006) grounded theory process, the data analysis process begins with open coding. All data sources, including interview transcripts, observation notes, media texts, and archival documents are systematically reviewed and broken down into initial codes. As patterns emerged, focused coding was applied to refine and synthesize the most significant and frequently occurring codes. I use the tactic of "clustering" (Miles & Huberman, 1994) to group themes with similar patterns and shared meanings into broader categories. Constant comparison was used throughout, ensuring that codes were examined across different data sources to identify

similarities, differences, and contradictions. The most recurring and conceptually rich themes are highlighted. In cases where data sources present contradictions or diverging differing perspectives, additional analysis was conducted to examine potential biases, contextual factors, or gaps in available information.

Once focused codes were established, themes are further refined through theoretical coding, where relationships between categories are explored to develop a cohesive conceptual framework. This iterative process involves identifying meta-themes that captured the essence of multiple data points, contextualizing findings within relevant theoretical frameworks, and constructing a cohesive narrative. Throughout the process, memo-writing helps tracking and reflecting on analytical interpretations, while theoretical sampling helps identifying, filling gaps in the data and strengthening emerging themes. Overall, the grounded theory analytical approach by Charmaz (2006) is provides a constructivist perspective ensuring findings are empirically grounded, while also allowing reflexivity and interpretive choices.

While grounded theory provides an inductive structure to identify patterns, themes, and relationships, discourse analysis lends a critical lens to move beyond descriptions of these patterns, themes, and relationships and interrogate how power and ideology shape those themes identified in the data. As the grounded theory begins with open coding to identify key themes and concepts, discourse analysis is applied to investigate the discursive strategies used by different social actors and to explore how those strategies construct meaning and influence public perceptions. By incorporating discourse analysis, the analysis process adds a layer of critical interpretation through examining the power dynamics embedded in textual languages and design choices. The integration of grounded theory and discourse analysis offers a rich, multi-

dimensional analysis that is not only data-driven but also allows for a deeper understanding of the social and political implications of the data.

Particularly, discourse analysis is well suited for research questions about values and cultural assumptions as it reveals how meanings are being constructed and communicated through choices (Machin & Mayr, 2012). Through systematic discourse analysis, I explore the deeper ideological and structural forces embedded in language, providing a nuanced understanding of how meaning is constructed and contested within the data. I employ several key techniques of discourse analysis systematically examine how meaning is constructed and how power, ideologies, and social norms are reinforced in collected data. These techniques include analysis of recurring themes and frames across texts, linguistic features such as word choice and metaphors, discursive strategies used to manipulate or persuade audiences, and choices of excluding voices or viewpoints (Wodak & Meyer, 2011).

By analyzing recurring themes and frames, I identify patterns in how certain themes are represented and how dominant narratives come to emerge across different sources. This includes exploring how certain topics are emphasized, omitted, or framed to align with specific ideological positions. Additionally, I pay close attention to linguistic features, such as word choices, metaphors, and tones to understand how textual language influences meaning. Specific terms and metaphors can evoke emotional responses, legitimize certain viewpoints, or marginalize alternative perspectives. For example, the language and metaphors of tech neutrality, frame technology as inherently objective, apolitical, and universally beneficial, obscuring the ways in which human biases, corporate interests, and regulatory choices shape technological development and implementation, thus legitimizing certain technological tools and systems while marginalizing critiques of their social and ethical implications.

In addition, I analyze discursive strategies, the rhetorical and linguistic techniques used by these actors to establish legitimacy in shaping public discourse about climate change. Examining these elements helps reveal how discourse operates as a form of social power. I also analyze choices of exclusion. I identify dominant narratives, contextualize the ways in which they are being conveyed, and expose alternative narratives that are missing or marginalized in the discourse. Exclusion can occur through omission, delegitimization, or marginalization of certain groups, reinforcing dominant ideologies while limiting alternative viewpoints. By interrogating these absences, I gain insights into the power dynamics and ideological assumptions at play in these cases.

Case 1: Climate Feedback & Climate Central (Scientist-led Institutional Fact-Checking)

Launched in 2015, Science Feedback is a nonprofit organization focusing on fact-checking and verification of scientific information, particularly in the media coverage. The nonprofit was founded by Emmanuel Vincent, a French climate scientist and was headquartered in Paris, France. Science Feedback specializes in two primary areas: climate science and health, which are "particularly prone to misunderstandings and misinformation"[2]. The organization's health branch, Health Feedback gained prominence during the COVID-19 pandemic through fact-checking viral false claims about COVID-19 vaccines. Science Feedback's efforts of flagging and debunking widely circulated false claims prompted tech platforms such as Facebook to label or reduce the spread of such content.

The organization's climate branch is operated as Climate Feedback, which focuses on fact-checking media reports, social media content, and public statements related to climate change and environmental science. Climate Feedback provides web-based annotating reviews

[2] Science Feedback. (n.d.). *About.* Science Feedback. https://science.feedback.org/about/

fact-checking media reports, social media content, and public statements related to climate change and environmental science. Climate Feedback builds a crowdsourcing global coalition for climate scientists to review the claims and news articles about climate change with ratings of scientific credibility and annotations of additional scientific contexts and references. In 2020, Climate Feedback reviewed multiple news articles that claimed arson was the main cause of the devastating Australian wildfires, downplaying the role of climate change. Climate Feedback's review highlighted that while some fires were caused by arson, the unprecedented scale and intensity of the fires were primarily driven by climate change-related factors like drought and extreme temperatures.

The reviews with web annotations offered by Climate Feedback are made possible by an annotation tool through Climate Feedback's partnership with the nonprofit Hypothes.is. The partnership provides Climate Feedback with an Internet browser plug-in, intended for Internet users to collaboratively review and critique online content (Wanucha, 2014). At Climate Feedback, the annotation tool enables the community-oriented review process in which scientists highlight controversial sections in original climate-related articles and annotate contextual information and peer-reviewed references.

In a standard review process, articles or claims related to climate change are selected based on their reach and potential to mislead. A group of qualified climate scientists with expertise in relevant fields is then asked to review the content. The accuracy of selected content is evaluated and rated by multiple experts. Based on consensus-driven reviews, each claim or article is then assigned to a scientific credibility score ranging from 2 (very low) to +2 (very high), then an overall verdict (e.g. mostly accurate, misleading, inaccurate, biased, etc.). Each review is provided with detailed explanations supported by peer-reviewed scientific evidence.

The final assessment, along with expert commentary and references, is published on the Climate Feedback website and promoted on their official social media accounts. Climate Feedback also reach out and provide reviews to journalists and editors of the outlet of the original article reviewed.

In 2016, Climate Feedback started to work with Facebook to fact-check articles being shared on its platforms (Mahoney, 2016). In 2019, Climate Feedback, through its parent organization Science Feedback, joined Facebook's third-party fact-checking Program to become an official fact-checking partner of Facebook as a part of its initiative to combat misinformation (Fischer, 2019). In this role, Climate Feedback fact-checks posts related to climate change, evaluates their accuracy, and helps label false or misleading content on the platform. According to Facebook, the selected fact-checking partners are independent third-party fact-checking organizations certified through the non-partisan International Fact-Checking Network (IFCN) or European Fact-Checking Standards Network (EFCSN)[3].

Similar to Climate Feedback's mission of promoting climate scientific knowledge in the public discourse, Climate Central is a US-based nonprofit organization that specificizes in research and communication of climate science. Headquartered in Princeton, New Jersey, Climate Central was co-founded in 2008 by a group of climate scientists, philanthropists, and science communicators who sought to bridge the gap between climate science and public understanding of climate change[4]. Climate Central focuses on providing data-driven analysis, visual tools, and scientific reports that explain the effects of climate change, such as rising temperatures, sea-level rise, extreme weather events, and climate impacts on local communities.

[3] Meta. (n.d.). *About fact-checking on Facebook, Instagram, and Threads*. Business Help Center. https://www.facebook.com/business/help/2593586717571940?id=673052479947730
[4] Climate Central. (n.d.). *About us.* Climate Central. https://www.climatecentral.org/what-we-do

The organization specializes in creating accessible and visually compelling resources and localized climate stories to help raise broader social awareness and foster informed policy decision-making about climate change.

Climate Central undertakes several key programs including Sea Level Rise, Climate Matters, Partnership Journalism, Climate Shift Index, and Realtime Climate. Among them, the first three projects are the flagship projects of the organization. The Sea Level Rise program provides data and visualizations on sea-level rise and its potential impacts on coastal communities. The tool allows users to see how different levels of sea rise may affect their local areas. The Climate Matters program was designed to help local television weathercasters incorporate climate science into their forecasts, providing a platform for meteorologists to communicate climate-related information effectively to their local audiences. The Partnership Journalism program facilitates collaborations between local news organizations and climate scientists through generating localized, data-driven, and compelling climate stories based on the specific climate risks faced by local communities that partner media outlets serve.

Over the years, Climate Central's data-driven research, localizing approach, and compelling visual storytelling have had major impact in public discourse about climate change. In 2021, the data generated visuals contrasting warming scenarios across global landmarks produced by the Sea Level Rise program gained coverage from 4,000 media outlets worldwide[5]. As of 2022, ten years after its initial inception, the Climate Matters program has built collaborations with more than1000 meteorologists and over 870 journalists across the US[6]. In

[5] Climate Central. (n.d.). *About us*. Climate Central. https://www.climatecentral.org/what-we-do
[6] Climate Central. (n.d.). *Climate Matters 10th Anniversary*. Climate Central. https://www.climatecentral.org/climate-matters/climate-matters-10th-anniversary

2024, the program continues to draw attention from influential national media such as *The New York Times*[7].

Climate Feedback and Climate Central jointly represent a distinct approach in addressing climate disinformation: science-driven, scientists-led institutional fact-checking. Despite some differences in their specific practices, both organizations focus on advancing science-based public discourse about climate change by leveraging scientific expertise and data-driven communication. Both organizations emphasize the importance of scientific accuracy in climate related information. Climate Feedback relies on a network of scientists and researchers to evaluate the credibility of climate-related information in media, while Climate Central employs climate scientists to produce and analyze data for their projects. The shared focus on science-driven content helps ensure that their resources are rooted in reliable, peer-reviewed science. Both organizations also build collaborations with news organizations and digital platforms to combat climate disinformation with science-backed information. Climate Feedback directly partners with Facebook to flag and debunk climate misinformation spreading on digital platforms, while Climate Central collaborates with journalists and weathercasters through the Climate Matters program and Partnership Journalism to strengthen scientific validity of climate reporting. These partnerships increase the reach and influence of both organizations in shaping the public perception of climate issues.

Both organizations can be seen as taking institutional approach of fact-checking in their shared commitment to using science-based methods to enhance climate communication and promote public access to accurate and reliable climate information. Like professional fact-

[7] See NYT coverage of Climate Matters program at: Buckley, C. (2024, June 20). The weatherman who tried to bring climate science to a red state. *The New York Times*. https://www.nytimes.com/2024/06/20/climate/weather-forecaster-iowa-climate-change.html

checkers, the validity of their work is dependent on whether it is perceived and acknowledged as neutral and unbiased by the public (Amazeen, 2015). But the fact-checking practices of Climate Feedback and Climate Central are also distinct from traditional fact-checking organizations, which usually aligns with established values and norms of professional journalism (Graves, 2016). Climate Feedback and Climate Central are founded and led by climate scientists, driven by values and norms of the scientific community. The priorities and concerns of both organizations may not always align with professional journalists.

Case 2: AllSides (Tech Entrepreneur-led Media Literacy)

AllSides is a media company co-founded in 2012 by tech entrepreneurs John Gable and Scott McDonald with the mission of exposing individuals to information from all sides of the political spectrum and promoting balanced perspectives in news coverage[8]. Based on its official website, AllSides was created with a mission to "free people from filter bubbles so they can better understand the world — and each other"[9]. The co-founder and CEO John Gable, who had a background in technology entrepreneurship and conservative politics, was motivated by his experiences to create a platform that would expose people to diverse opinions (Harris, 2019). The company provides news coverage of social and political issues, such as climate change from various political viewpoints from left, center, to right, allowing readers to compare how different media outlets report on the same issues.

The core of AllSides' practice is its media bias ratings, a system rates perceived media bias of news outlets based on their political leanings. These ratings are derived from a combination of rating methodologies, including editorial content, crowd-sourced input, and evaluations from a diverse group of reviewers with varying political beliefs. The core methods

[8,12] AllSides. (n.d.). *About AllSides*. AllSides. https://www.allsides.com/about

include Blind Bias Surveys, where participants from across the political spectrum rate content without knowing its source, helping to avoid preconceived judgments. In a sample blind bias survey, AllSides uses newsletters, website, mobile app, and social media platforms to locate potential volunteer readers. AllSides then provides a bias rating test for volunteer readers to self-report their own political bias. After self-reporting political bias, volunteer readers are asked to rate articles for political bias. Staff at AllSides with different political leanings select articles from news media outlets to be reviewed by readers. AllSides normalizes the review data collected from readers to reflect the social and political bias of the general US population. Using natural language processing, the media bias rating classifies news media outlets into five categories: “left”, “lean left”, “center”, “lean right”, and “right”. The media bias rating reconstructs and presents the news content from across political spectrum aiming at fixing political polarization (Esposito, et al., 2020).

Additionally, editorial reviews are conducted by a multipartisan panel of six to nine reviewers who assess news content based on its language, framing, and story selection. The panel review and identify types of media bias listed by AllSides, including slant, spin, sensationalism, etc. Panelists review online archives of a certain media outlet, then individually assign a numeric rating between -6.0 and +6.0, that they personally believe best represents the bias of the media outlet, which then transcribed into a weighted average[10]. AllSides also incorporates third-party data and community feedback. With third-party data, AllSides takes into account external data and studies from academics and media watchdogs to cross-validate their ratings. AllSides also actively encourages its users to provide feedback on the bias ratings of

[10] AllSides. (n.d.). *How AllSides rates media bias*. AllSides. https://www.allsides.com/media-bias/media-bias-rating-methods

different outlets. This feedback is continuously collected, monitored, and used as references for enhanced ratings.

By using multiple approaches to generate media bias ratings, AllSides seeks to shape individual understanding of important social and political issues like climate change through reconstructed media discourse through their lens of media bias. In a sample "perspective blog" about climate change authored by "AllSides staff", three stances about human caused climate change were presented, including "humans are the primary cause of climate change", labeled as "lean left"; "natural factors also contribute meaningfully to climate change", labeled as "center"; and "the extent of human contribution is uncertain or overblown", labeled "lean right". For each stance, AllSides staff writers complied supporting arguments with references from various media outlets. Notably, for the "lean-right" stance, most of the supporting materials come from right-wing outlets, who are also active agents spreading climate disinformation such as *WSJ* Opinion, *New York Post*, *The Epoch Times*, and Netherland-based fossil fuel backed climate denial group the Climate Intelligence Foundation (AllSides, 2024).

As a tech entrepreneur led intervention to political polarization and disinformation, AllSides's media bias ratings can be seen as broadly fit into the media literacy intervention to address disinformation, aiming at informing individual news readers about ideological underpinnings of media content and value orientations of news organizations. By exposing readers to a variety of media content across the political spectrum, such media literacy intervention efforts intend to foster skills needed to identify underlying biases of news content and seek diverse perspectives, thus improving ability to critically engage with media content in a less polarized way. AllSides also operates AllSides for Schools and Mismatch, both digital

literacy initiatives designed to provides resources for teachers and students to develop skills to navigate online information environment and promote civic conversations[11].

However, as a media organization built by tech entrepreneurs, AllSides's media literacy approach is fundamentally different from traditional media literacy approaches. For co-founder John Gable, devising a tech-based media company like AllSides comes from his understanding that digital information technology could help fix the problem of political polarization instead of driving it (Gable & Brechter, 2020). AllSides emerges at a time when professional journalistic gatekeeping and normative role of journalists have been generating growing public scrutiny and distrust. AllSides's conceptualization of perceived "media bias" indicates growing efforts of challenging journalistic authority and shaping public discourse from actors with increasing economic, social, and cultural capital. AllSides's intervention to political polarization is predicated on elevated value of transparency and balance of perspectives, which embodies long running techno-libertarian tradition of Silicon Valley.

Case 3: Facebook (Platform Self- Regulation)

Facebook, now part of Meta, was launched in 2004 by Mark Zuckerberg and his college friends. Initially designed as a social networking site for Harvard students, it quickly expanded to become the world's largest social networking platform, with billions of users worldwide. Over the years, Facebook diversified its offerings by acquiring platforms like Instagram in 2012 and WhatsApp in 2014, further solidifying its position as a tech giant. Throughout its history, Facebook has played a significant role in shaping digital communication and social interactions. As one of the most widely used digital platforms in the world, Facebook has also faced growing public scrutiny over issues related to user privacy, misinformation, and data exploitations. In

[11]AllSides. (n.d.). *AllSides for schools.* AllSides. https://www.allsides.com/schools

2018, the Cambridge Analytica scandal has aggravated public concerns about Facebook playing host to practices undermining democratic political engagement and led to calls for stronger regulations of the platform. The incident does not only expose the failure of Facebook in protecting user privacy. More importantly, it indicates the accountability of platforms in shaping public understanding of social and political issues.

In climate communication, digital platforms such as Facebook have been widely used by fossil fuel operatives in spreading climate disinformation. Disinformation campaigns often use recommendation algorithms of Facebook to target individuals who are receptive to climate denials and doubt. Despite the company's measures of curbing climate disinformation, such as launching the platform's Climate Science Center, which elevates credible climate sources, climate denials and misleading climate content are still widely circulating on its platforms. In 2021, independent nonprofit climate news organization *Grist* covers an investigative report of climate-related content on Facebook, highlighting how Facebook allowed climate disinformation to proliferate through its platform unchecked. The report points out that only a small percentage of misleading climate content were flagged with fact-checking labels or were directed towards the official Climate Science Center (Winters, 2021).

Despite their ability to curb the spread of disinformation, digital platforms are often exempted from legal liability of user content published on their platforms. In the U.S., Section 230 of the Communications Decency Act grants immunity to platform operators to be held accountable for content published by users on their platforms. Platforms like Facebook also use technical neutrality and free speech as frequent excuses to sidestep accountabilities of algorithm-generated misinformation and social vulnerabilities (Russell & Clark, 2018). Digital platforms today are serving the role of moderators of the public discourse, setting norms and rules,

categorizing content, and judging the visibility of information (Gillespie, 2018). These forms of governance raise concerns about the distribution of legal and social responsibilities and how moderation and regulation practices are constructed (Suzor, 2018).

As the largest social networking site in the world, Facebook's content decisions shape how millions of people understand and collectively act on critical global challenges like climate change. Given Facebook's vast influence and the high stakes involved in addressing climate disinformation, the self-regulatory tactics employed by Facebook need close examinations. While Meta claims to reduce the spread of misinformation through third-party fact-checking and algorithm adjustments, the internal mechanisms by which these processes operate remain opaque. These content policies are often shaped by pressures from governments, political ideologies, and market. In 2025, Meta CEO announced a major shift in the company's content moderation policies by replacing the third-party fact-checking program with the user-driven "Community Notes" system. The shift reflects the tech giant's strategic alignment with the political right and its right-leaning ideological preference for decentralization and deregulation, under the political climate of Donald Trump administration.

Facebook's content moderation polices have raised concerns about algorithmic bias, enforcement of policies, and lack of public oversight. The shifts of these content policies also reveal challenges for platform self-regulation to serve as a functioning mechanism of addressing disinformation. Without external independent oversight, platforms can modify or abandon their commitments to combating disinformation based on changing political dynamics rather than prioritizing the integrity of public discourse and democratic norms. Additionally, the business model of Facebook is driven by advertising revenue and engagement metrics. Some of Facebook's advertising revenue comes from entities spreading climate disinformation. Although

it has pledged to remove such ads, the process of monitoring and enforcing these policies may be compromised by the desire to maintain advertising revenue. Meanwhile, the engagement-based incentives prioritize content that drives user engagement, even if it is harmful or misleading. Close scrutiny of these self-regulatory measures helps us critically understand platform regulation as a solution to address climate disinformation.

Outline of the Chapters

Chapter 2 examines how scientist-led fact-checking nonprofits, tech entrepreneur-led media company, and digital platform establish legitimacy of shaping public discourse about climate change. Establishing legitimacy is a central concern in boundary work of these social actors because it is inextricably linked to the public recognition and social acceptance of their role as knowledge producers responding to the epistemological challenges brought to climate knowledge production. Adopting the framework of "civic epistemology" (Jasanoff, 2005), I argue that tech-driven practices establish legitimacy through processes in which they justify their institutional norms, values, and practices. These processes include three primary legitimizing strategies: building trust, establishing expertise, and demonstrating practices. I identify and compare these strategies used by scientists, tech entrepreneurs, and tech companies and discuss gains and losses in these social actors' boundary work.

Chapter 3 turns to examine how scientists, tech entrepreneurs, tech companies, and journalists leverage digital technology, the "boundary object" in their efforts to address climate disinformation. The narratives around technology reflect how these actors perceive the problem of climate disinformation and how they arrange priorities in their efforts to address the problem. Adopting the mediation framework by Lievrouw (2014), I examine three mutual shaping processes of digital technology and tech-driven practices: reconfiguration of technological

artifacts, remediation of communicative practices, and reformation of social arrangements. First, I identify three major ways technological reconfiguration manifests in these practices: creating material conditions, economic premises, and social justifications. Second, I argue the remediation process manifests through two aspects of practices. Social media platforms serve as critical communication infrastructures for tech-driven practices. Meanwhile, these organizations are also leverage the material properties of social media platforms to reach communicative goals. Third, I suggest that new patterns of social relationships and organizational dynamics emerges through the reformation process, including new partnerships and collaboration among actors, and new narratives of technical neutrality and algorithmic objectivity projected by Silicon Valley elites.

Chapter 4 asks what implications these tech-driven practices have for journalism. Building on previous chapters, this chapter focuses on how journalism, the site of constant boundary contestation with its boundaries continuously blurring by technological shifts adapt to the changing conditions of climate communication. I identify new forms of journalistic practices; examine the tension among persisting and emerging journalistic roles, norms, and values; and discuss lessons for reforming journalistic norms and practices, redefining legitimacy of journalistic sources, and reimagining the institutional boundaries of journalism.

In general, I have two major goals in this dissertation: examining the norms, values, and cultural assumptions embedded in tech-driven practices working to address climate disinformation; and investigate the social, political, and technological forces that shape these practices. My hope is that this inquiry will shed some light on our understanding of various intervention efforts to address climate disinformation and contribute to the ongoing disinformation research.

Chapter 2. Establishing Legitimacy

The Question of Legitimacy

In 2010, Climate Central, a nonprofit based in Princeton, New Jersey, together with partner organizations received a National Science Foundation grant to start a pilot program working with local meteorologists to communicate climate impact to local audiences. Jim Gandy, based in Columbia, South Carolina became the first local TV meteorologist in this later expanded program, Climate Matters. Gandy had been interested in scientific facts about climate change, but "had never had time to do the research necessary for on-air segments" (Schwartz, 2022). The Climate Matters program provided Gandy with localized and science-backed climate contents, including tools such as visuals, maps, graphs, and data analytics to help him to explain to local audiences how climate change affects their community in Columbia, South Carolina.

For Climate Central, the Climate Matters program worked surprisingly well. Researchers from Climate Central and partnering organizations had initial concerns about viewers resisting climate change as being a politicized topic in their local weathercast. But based on my interview with Peter Girard, Director of Communication at Climate Central, it turned out that the test program with Jim Gandy got virtually no criticism (P. Girard, personal communication, December 3, 2021). Following the initial success, Climate Central officially launched Climate Matters as full-time program in 2012 with 12 meteorologists. In ten years, the program has expanded to 247 locations in the U.S. partnering with over 1900 TV meteorologists and journalists.

Winning the trust of TV meteorologists are crucial for establishing and expanding the program. As an increasing number of meteorologists participate in the partnership, the more climate science information they receive, the more they come to consensus about the cause and

impact of climate change. By 2017, 95 percent of TV weather forecasters acknowledged that climate change is indeed happening. By 2020, 80 percent recognized human activities as the main contributor (Schwartz, 2022). The scientific information and technological tools provided by Climate Central play an important part in gaining trust of local meteorologists.

But earning the trust of meteorologists is just a beginning step for Climate Matters. The larger goal of the program is to tell stories with local climate impact to local audiences through TV meteorologists. However, being perceived by the public as legitimate knowledge producer is a much more daunting task: average viewers unlikely share the same level of understanding in scientific information with meteorologists but are likely sorted by various social and political values. Supplying scientific data and analytics is not sufficient for persuading audiences of the climate crisis.

The key to establishing the legitimacy of the program lies in the perceived expertise of trusted messengers: local audiences already trust their weather forecasters as credible messengers of weather and climate information. Regardless of the partisan divide and ideological differences among these audiences, local meteorologists are a constant presence in their communities. As the primary information source for local audience with high visibility on local TV, meteorologists foster a unique kinship with the local community that renders them legitimacy in making accessible scientific claims about climate change. By capitalizing on local trust and recognition of local meteorologists as authorized voices of scientific knowledge, the Climate Matters program makes the climate crisis relevant, tangible, and compelling for local audiences and in turn fosters legitimacy of their role as climate knowledge producers.

The success of Climate Matters underscores how important it is for Climate Central to establish legitimacy in order to effectively communicate climate science to the public. Their

power to shape public understanding about the climate crisis is dependent on the extent to which the public recognizes them as being reliable and trustworthy public knowledge producers. In fact, establishing legitimacy is a central concern for all social actors striving to provide technology driven solutions to address climate disinformation. In this chapter, I examine how tech-driven practices, rooted in different professional backgrounds attempt to establish legitimacy. Specially, these practices include Climate Central and Climate Feedback, fact-checking nonprofits led by climate scientists, AllSides, media company founded by Silicon Valley entrepreneurs, and Facebook, digital platform owned by tech giant Meta.

For these actors, their efforts to shape public discourse about climate change constitute boundary work of making public knowledge claims about climate change. To establish legitimacy as climate knowledge producers also means to demarcate their professional practices from other professionals in climate communication. Whether it is climate scientists, entrepreneurs, or tech companies, the goal of establishing legitimacy is crucial for setting boundaries around their knowledge practices and prioritizing their forms of knowledge production in perpetually contested boundary disputes (Gieryn, 1999). Legitimacy grants these social actors with public recognition and social acceptance, hence power in defining and defending their ways of understanding and interpreting the truth about climate change. Indeed, the issue of legitimacy is pertinent to the epistemology of climate change because it deals with issues such as what we know about climate change, how we know what we know about it, what constitutes valid explanation and sound evidence to the problem, and how we make judgements about addressing the problem (Callison, 2014).

Legitimacy is, however, more than a central goal for social actors to define and defend their practices of shaping climate discourse. It is also a prerequisite for representing public

knowledge in the broader context of post-truth politics. In the post-truth Western liberal democratic societies, the shifting digital communicative infrastructures, declining public trust in democratic institutions, and eroding democratic norms create the epistemic rupture of public consensus and threatens institutional legitimacy of traditional knowledge authorities like scientists and journalists (Bennett & Livingston, 2018; Carlson, 2018a; Iyengar & Massey, 2019). Meanwhile, right-wing propagandists and fossil fuel interests strategically manipulate the public discourse through distorting scientific facts and misrepresenting contested social values. The epistemic complexities of climate communication in the post-truth political contexts further amplify the concern of legitimacy.

While legitimacy is an abstract construct and is conceptualized in various ways, in this dissertation, I adapt the analytic framework of "civic epistemology" to conceptualize the process of establishing legitimacy (Jasanoff, 2005). The framework of civic epistemology helps articulate the process in which the public comes to perceive culturally specific knowledge claims as credible and trustworthy and how they are being used as foundations for collective societal choices. According to Jasanoff (2005), civic epistemology provides an analytical tool for understanding legitimacy in knowledge production by accounting for constitutive dimensions of public knowledge making, such as styles of public knowledge-making, trust, expertise, and demonstration. Through examining the constitutive forms of knowledge ways, civic epistemology also offers explanatory means to comparatively analyze diverse public understanding and responses to science and technology (Jasanoff, 2005).

Adapting the framework of civic epistemology, I argue that social actors building tech-driven practices that address climate disinformation establish their legitimacy through processes in which they justify their institutional norms, values, and practices. In this dissertation, I focus

on three primary legitimizing processes: building trust, establishing expertise, and demonstrating practices. Analyzing data collected from multiple sources reveals that trust, expertise, and demonstration consistently emerge as central themes in how different social actors negotiate their legitimacy. While Jasanoff's (2005) comprehensive framework includes additional dimensions, the empirical patterns in the data suggest that these three dimensions are particularly salient. Therefore, examining the three processes ensures a more focused and empirically grounded analysis that captures the significant patterns and dynamics observed in the data.

After establishing these three broad dimensions, I identify recurring themes such as "scientific objectivity" and the "peer review system" and group them as strategies of establishing expertise shared by scientist-led nonprofits Climate Central and Climate Feedback. Through concept maps, themes are visually or systematically organized to show relationships among them. Clusters are then reassessed, merged, or subdivided to represent the data. For example, the "peer review system" is merged with other relevant themes such as "academic credentials and achievements" as "boundary policing criteria", a category of legitimizing strategies employed by Climate Central and Climate Feedback to establish scientific expertise. Following the same procedures, other salient themes and subthemes are clustered and refined into categories of legitimizing strategies. Once categories are well-defined, they are integrated into the adapted conceptual framework of civic epistemology.

Table 1 below summarizes key themes and subthemes identified during the data analysis process. It provides an overview of how recurring patterns were clustered into broader categories of legitimizing strategies employed by these actors, with comparisons of common and divergent key themes identified among these cases.

Table 1

Legitimizing Strategies (Adapting the Framework of Civic Epistemology)

	Climate Central	Climate Feedback	AllSides	Facebook
Building trust	• Partnering with media outlets • Contextualizing climate science		• Prioritizing transparency	
Establish expertise	• Committing to scientific objectivity • Employing boundary policing criteria • Capitalizing on interactional expertise		• Challenging the authority of journalists • Exploiting the abstraction of digital systems	
Demonstrating practices	• Broker of policy alternatives	• Science arbiter	• Increasing visibility • Demonstrating transparency	

These legitimizing strategies are essential for producing and disseminating public knowledge. Trust, a predisposition of accepting scientific claims, usually operates independently of the science knowledge production in the scientific community but articulates in multiple contexts and is "inflected by culture" (Jasanoff, 2011, p. 130). Expertise, in disputed and politicized context of climate communication, can often serve as an indicator of reliable and credible public knowledge (Jasanoff, 2005), and a vital component bridging scientific knowledge, advocacy, and policy decision-making (Callison, 2014; Collins & Evans, 2007). Demonstrating practices publicly is crucial because increasing public involvement in science and technology development raises new requirements about disclosure and transparency of knowledge practices in the public eye (Jasanoff, 2005). On the other hand, the hybrid sociotechnical systems make it necessary for any social actors vying for legitimacy as public knowledge producers to perform rituals and practices in interactions with different media logics

(Chadwick, 2017), much like journalists demonstrating professionalism to defend authority in news making amid challenges from emerging digital media outlets (Carlson, 2017).

Building Trust

Central to the success of the Climate Matters program is building public trust in climate messengers: local TV meteorologists who can effectively inform and engage with local audiences in climate communication. However, as the primary messengers of climate science, scientists have suffered declining public trust, especially after the COVID-19 pandemic (Pew Research Center, 2023). In his famous 2004 article *"Why Has Critique Run Out of Steam? From Matters of Fact to Matters of Concern,"* Bruno Latour argues that the traditional mode of critique that privileges "matters of fact" should shift to focusing on "matters of concern". The argument highlights the socially constructed nature of scientific facts, but it can also be misused by climate denialists to undermine scientific consensus. By questioning the objectivity of facts and emphasizing the entanglement of science with politics and society, Latour's critique can be weaponized and twisted by climate denialists and conspiracy theorists as testaments to scientific facts always being under manipulation of scientists, blurring the line between science and ideology and fostering endless skepticism to delay climate action (Kofman, 2018; Risen, 2022).

In fact, Latour's argument of "matters of concern" advocates for a constructive approach to address global challenges like climate change. This approach highlights the social, political, and cultural contexts in which facts are constructed. Latour's critique hence pinpoints a long-standing issue in climate science communication: the problem with lost trust in climate science has less to do with getting facts straight. Rather, it has more to do with the socially constructed public trust in science and scientists. When asked about what they perceive to be the biggest challenge for climate change communication, Girard put it simply: "Scientists" and explains:

"[…] the truth is science can be inaccessible, and scientists are not people that the majority of the public encounter on a regular basis." (P. Girard, personal communication, December 3, 2021)

The decentralized communication infrastructure has opened a wide range of possible ways for the public to engage with the scientists. Scientists, however, are not always the most ideal communicators of their research. As Sutter (2022) argues, the communication problem of scientists is a structural one. Most top research institutions reward scientists who have strong publishing records and research grant support through tenure and promotion, but public scholarship and outreach communication are often excluded in the evaluation criteria. Boykoff (2019) also suggests that public communication and engagement are often seen as "extensions" rather than "components" of scientists' professional responsibilities and competencies (p. 187). The lack of career incentive and training for scientists to engage in public communication has consequences for climate communication. As original producers of the scientific knowledge, climate scientists are indispensable in the process of generating data, devising research design, collecting results, and releasing findings to the press. However, their involvement often stops when media professionals take over the story: stories about scientific discoveries become isolated products detached from its creators.

The problem with detached scientists is twofold. First, the interest of different media outlets does not always align with the scientific community (Sutter, 2022). In networked information environment, isolated scientific statements are easy prey for manipulation of disinformation agents, propagandists, and conspiracy theorists to serve their political agenda. Scientists increasingly found themselves caught in the predicament with their messages distorted or taken out of contexts especially for politicized issues like climate change (Chinn et al., 2020).

Second, the human dimension of the scientific findings is often detached from scientific findings. As Latour (2004) argues, the focus on "matter of concern" requires scientists to highlight values and relevance of science in representing knowledge of shared concerns. The detachment of scientists from the contexts of public communication creates an engagement gap between the scientific knowledge produced in the laboratory and the knowledge communicated to the public for policy deliberation (Boykoff, 2019; Jasanoff, 2005; Latour, 2004). The engagement gap further dwindles public trust in scientists and scientific knowledge because detached scientists in public discourse aggravates the relevancy crisis of academic institutions in public life when social media and digital technology play a more prominent role in driving public discourse about science and scientific research (Hoffman, 2016).

The problem of detached scientists highlights the communicative aspects in building trust in science communication. While efforts of building public trust in science often focus on socio-psychological aspects of trust, such as interests in science (Motta, 2018), Climate Central and Climate Feedback shift the focus of building public trust to the communicative aspects: repairing the broken social relationships between scientists and the public that undergirds declining trust in climate science. For both organizations, building public trust take two major approaches: through partnering with information outlets such as media organizations and digital platforms and through contextualizing scientific knowledge. Both approaches are directed towards addressing declining public trust in detached scientists. Through partnering with media outlets and digital platforms, Climate Central and Climate Feedback aim at involving scientists, the primary producers of scientific knowledge directly in the communicative process to prevent potential distortions and manipulations of their research. Through contextualizing climate science in accessible and tangible ways, both organizations target on revealing the social and cultural

contexts in which scientific research is conducted while elucidating the "human dimension" of scientific research that is missing from detached scientists (Hulme, 2009).

Partnering with Media Outlets

The Partnership Journalism program of Climate Central exemplifies the approach of partnering with media organizations to rebuild public trust in climate scientists. The partnership program was created to facilitate collaborations between local newsrooms and climate scientists at Climate Central to collaboratively produce climate news stories for local audiences. Girard describes the partnership as "active collaboration", emphasizing that it is not a "constant model" in journalism partnerships (P. Girard, personal communication, December 3, 2021). Indeed, Climate Central's partnership with journalists highlights the "co-production" model in climate journalism, in which blurred professional boundaries among networks of NGO professionals and journalists bring about joint production of climate content (Lück et al., 2016). On its website, Climate Central describes this co-productive process in the Partnership Journalism Project as:

> A partner outlet contributes local reporting, including field reporting, photography and some editing for a story. We contribute data and charts plus a science reporter and an editor. For a text story, we help craft a feature in a way that puts climate change in appropriate and accurate context. For broadcast media, we provide story and interview suggestions and help develop and review scripts. Climate Central's researchers assist with fact-checking.[12]

Unlike typical science nonprofits partnering with media outlets, in which science nonprofits mostly work as sources, Climate Central does not just supply scientific research data to journalists, they also provide editorial and writing support, share bylines with journalists—

[12] Climate Central. (n.d.). *Partnership Journalism*. Climate Central. https://www.climatecentral.org/partnership-journalism

taking over traditional roles of news editors. The deep integration in the news production process, according to the interview with Girard, offers mutually complementary advantages to both Climate Central and their local journalist partners. Local journalists are able to utilize scientific data and information from latest climate research, strengthening the accuracy of reporting. At the same time, Climate Central can reach community audiences more effectively through their trusted local media sources.

Legacy media organizations are not the only institutions scientist-led nonprofits build partnerships with. Besides collaborating with traditional news media outlets to shape the climate news production process, scientist-led nonprofits also build partnerships with major digital platforms at the dissemination end of climate information. In a networked media environment, digital platforms serve as increasingly prominent channel for science communication. Recognizing the importance of involving digital platforms to repair the relationship between scientists and the public, both Climate Central and Climate Feedback collaborate with Facebook. The arrangements of these collaborations, however, take different forms for these two organizations.

Though not directly linked to official partnerships with Facebook, Climate Central acts as a "member of steering groups" of the digital platform (P. Girard, personal communication, December 3, 2021). In 2019, the organization was also funded by grants from Meta Journalism Project, initiative created by Facebook's parent company to inform underserved communities about climate change through ethnic media leaders (Meta, 2019). Climate Feedback, in comparison, is an official third-party fact-checking partner of Facebook. The parent organization of Climate Feedback, Science Feedback has been a part of Facebook's third-party fact-checking program since 2019 through the International Fact-Checking Network (IFCN). Of over 50

organizations participating in the program, Science Feedback is also "the only organization dedicated to verifying information in scientific fields" (Science Feedback, 2019). In 2022, through Meta's partnership with IFCN, Science Feedback was funded by Meta's Climate Misinformation Grant program (Meta, 2022a). Facebook was also listed as one of the major partners and donors of Climate Feedback. The commercial partnership with partner tech institutions such as Facebook also accounts for "at least 5% of Science Feedback's revenues since 2015".[13]

Whether these partnerships with digital platforms are effective in addressing climate disinformation remains an open question. Both Climate Central and Climate Feedback acknowledge that they play minimal role in influencing Facebook's content moderation decisions. According to Girard, Climate Central is "not an advisor… critic or a policy participant" for Facebook (P. Girard, personal communication, December 3, 2021). Climate Feedback, as a third-party fact-checking partner, is not involved in Facebook's decision making at any level. Nikki Forrester, Editor of Climate Ecology at Climate Feedback describes how Facebook makes its own content decisions, regardless of their fact-checking results:

We essentially determine whether something is false, or misleading or lacks context or whatever, and will provide that information to Facebook, so that they can be aware that misinformation is present on the platform, and then they kind of choose how to move forward from there. (N. Forrester, personal communication, June 24, 2021)

Contextualizing Climate Science

Besides partnering with media outlets and digital platforms, for both Climate Central and Climate Feedback, another approach to building trust in climate science is through

[13] Science Feedback. (n.d.). *Partners, funders & donors*. Science Feedback. https://sciencefeedback.co/partners-funders-donors/

contextualizing scientific knowledge. As Hulme (2009) contends, the reasons why we disagree about climate change have to do with epistemological questions: what we consider as the "truth", how we use scientific evidence to assess risk, what we believe to be legitimate role of scientific knowledge in collective decision making. The social, cultural, and historical contexts of climate science play significant roles in shape how we understand the climate crisis. Through contextualizing climate science in tangible ways, scientist-led nonprofits like Climate Central and Climate Feedback can transform abstract climate science into accessible stories and information for average audiences to make sense of the epistemological contexts of scientific knowledge about climate change, thus it is an essential approach in their efforts of bridging the gap between climate scientists and the public. For example, Climate Feedback underscores their role of providing contextualized scientific knowledge for the audiences in the fact-checking process. Forrester told me in the interview: "our role is really to figure out what they (scientists) are saying and then put that into context for the readers" (N. Forrester, personal communication, June 24, 2021).

A sample article review from Climate Feedback comes with an overall verdict based on the scientific accuracy of the article. But beyond that, Forrester said that Climate Feedback also explains how the verdict is being made and why certain claims are being rated as incorrect or misleading (N. Forrester, personal communication, June 24, 2021). In a sample review, scientists working with Climate Feedback identify logical fallacies such as flawed reasoning, cite graphs and from authoritative sources such as IPCC and NOAA, and quote in-context explanations from scientists responding to the disputed claims. The review also contains hyperlinks to references, charts, and graphs of the related scientific background information. In addition, hyperlinks are provided under names of all the reviewers and contributing scientists directing audiences to their

scholarly profiles or websites of their affiliated professional institutions. These contextual information helps reporters and average readers make sense of scientific facts not though illustrating esoteric methodologies of science, but through revealing the social and cultural contexts in which climate science is made, such as the expertise of the reviewers and logical and theoretical background of a contested claim.

Climate Central's approach in contextualizing climate science emphasizes on localizing the contexts of climate science. In Partnership Journalism program, climate researchers actively collaborate with local journalists to co-produce the climate news stories related to local audiences. In Climate Matter program, climate scientists work with local TV meteorologists to make the connections between climate impact and local communities. In Sea Level Rise Program, data visuals are designed to simulate the impact of coastal flood hazards in landmark locations globally and locally. Girard stresses that the goal for Climate Central is to "make climate science more accessible to the audiences that it influences" (P. Girard, personal communication, December 3, 2021).

Through localizing the context of climate science, Climate Central helps translate climate impacts into "something applicable, like literally in your backyard" (P. Girard, personal communication, December 3, 2021). According to Boykoff (2019), the localizing approach is important in climate communication because it builds relevancy of climate science to "first person perceptions" of personal, present, and local risks (p. 162). Through elucidating climate impact in the local contexts, audiences have an easier time perceiving once abstract climate science and applying it to their life experiences. Contextualization also turns objective and abstract climate science into interpretive collective knowledge making that eventually

contributes to restoring public trust in science and reclaims the guiding role of science in public life (Makri, 2017).

Both approaches to building partnerships with media organizations and contextualizing climate science reflect the priority of scientist-led nonprofits in obtaining legitimacy as knowledge producers: bolstering public trust in climate scientists and their research. These approaches also point to what scientists-led nonprofits perceive to be the core challenges of climate communication: the esoteric process of climate scientific research, the engagement gap between scientists and the public, and the changing communicative contexts of public communication.

Prioritizing Transparency

Scientist-led nonprofits are not the only social actors who recognize the shifting contexts of public communication. Silicon Valley actors such as AllSides and Facebook are also leveraging the changing information environment to build public trust in their legitimacy of shaping public discourse. AllSides, the Silicon Valley media company that has adopted a media bias rating system, highlights the value of transparency in their practices as a strategy to build public trust in their practice. AllSides's algorithmic media bias rating system is built upon the conception that all media outlets have partisan biases, and these biases lead to manipulation and misinformation. With its media bias rating system, AllSides makes these biases transparent and expose individual audiences to a range of diverse perspectives, which helps reduce political polarization and misinformation.

The assumption behind this line of reasoning is that media biases are inherently fixed entities that can be measured, classified, and displayed through a "transparent" rating system consists of multiple rating methods. When institutions throughout Western democracies face the

challenge of declining public trust, Silicon Valley tech entrepreneurs capitalize on the public trust crisis in of legacy news media, the traditional purveyors of public knowledge. AllSides attempts to build its legitimacy in public knowledge production through challenging the contested journalistic value of objectivity and privileging the transparency value in public knowledge making. Julie Mastrine, Director of Marketing at AllSides highlights the importance of being transparent about political biases in reducing political polarization and disinformation in the interview:

> We believe that when bias is hidden that it can manipulate and divide us, so we make bias transparent to help people get out of their filter bubbles, and we believe that when you understand the other side, you can actually reduce harmful polarization and toxic relationships. (J. Mastrine, personal communication, May 14, 2021)

AllSides's discursive prioritization of the transparency value manifests in two approaches: transparency through diversifying media bias rating methodology and transparency through displaying political biases of team members. In the first approach, AllSides emphasizes their employment of a variety of rating methods in producing the media bias rating system. When disclosing information about rating methodologies on its website, AllSides lists methods such as editorial review, blind bias survey, independent research, third-party data, and community feedback[14], with brief descriptions of each rating method. For methods like independent review and third-party data, AllSides emphasizes the criterion of "being transparent" for evaluating a media outlet or incorporating data from a third-party, though lacks further clarification of what being "transparent" means in the context. Having multiple rating methods, for AllSides, serves to justify their product to be "arguably the most credible media bias

[14] AllSides. (n.d.). *How AllSides rates media bias*. AllSides. https://www.allsides.com/media-bias/media-bias-rating-methods

ratings"[15]. Mastrine also emphasizes that "we are really transparent about our methodology and how we rate bias" (J. Mastrine, personal communication, May 14, 2021).

A close look at these various rating methods, however, reveals that not all methods hold the same weight in the media bias rating system. According to Mastrine, the blind bias surveys and editorial reviews are the two "most robust methods" (J. Mastrine, personal communication, May 14, 2021). In blind bias surveys, participants, whom AllSides refers to as "average Americans across the political spectrum"[16] use AllSides's bias rating tool to self-identify their own political bias and provide ratings of bias of articles from media outlets with source being blinded. However, it remains unclear how robust the design of the self-bias rating survey is, given it only contains eight broad policy questions and uses a five-point scale ranging from "not important" to "extremely important" for assessing individual attitudes about broad policy issues[17]. The bias rating survey also raises further questions about who these participants are, what motivations and incentives they have for participating, and how the process is being administered.

Another approach for AllSides to privilege the transparency value is through disclosing self-rated diverse political biases of its staff members. For AllSides, having members with diverse political orientations and displaying these self-rated political orientations indicates that transparency value is embedded in their practices, thus justifies the credibility of the media bias rating results they produce. In the interview, Mastrine stresses that the organization does "like to be transparent about" the political biases of staff members and that politically diverse composition of the staff members ensures "we remain balanced":

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[15] Ibid.
[16] Ibid.
[17] AllSides. (n.d.). *Rate your bias.* AllSides. https://www.allsides.com/media-bias/rate-your-bias

> Because our team has people from the left, center and right. We have people who are very strong religious conservatives, and then we have people who are extremely progressive liberals, and then we have people in between. So you can actually go to our team page and see that we are transparent. (J. Mastrine, personal communication, May 14, 2021)

Similarly, Facebook also discursively deploys the transparency value to build public trust in their efforts of countering disinformation on the platform. Meta, the parent company of Facebook launched the "Transparency Center", an initiative to provide users with insights into how the company enforces its policies, manages data, and addresses various issues on its platforms. The Transparency Center features Facebook's content moderation strategy of "remove, reduce, inform"[18]. The Transparency Center serves as a hub for public access to resources such as reports on content moderation, policy enforcement, government requests, and research tools. One of the transparency programs, Facebook Open Research and Transparency (FORT) pledges to share data with independent researchers and "releases reports that make company activities more transparent" (Li et al., 2022). Through the Transparency Center, Meta pledges to enhance transparency and accountability by regularly publishing reports and updates about its operations and policies.

Meta also features its partnership with the International Fact-Checking Network (IFCN) as one of the most prominent approaches to tackle climate misinformation (Meta, 2021a). In 2022, Meta invested 1 million in partnerships with IFCN to fund fact-checking organizations (Meta, 2022a). In a press release, Facebook states that all fact-checking partners receiving funds and working with Facebook need to follow the IFCN's community Code of Principles, including "transparency of sources, transparency of funding and organization, and transparency of

[18] Meta. (n.d.). *At Meta, we're committed to giving people a voice and keeping them safe.* Transparency Center. https://transparency.fb.com/

methodology" (Meta, 2021b). Newsfeed, which drives user engagement is the central piece in Facebook's profit model. In a memo outlining guidelines for news content clients, Facebook includes "transparent" as one of the principles for Facebook algorithm to judge the quality of news content.[19] However, except vague description of prioritizing content that "have editorial transparency" and "publishers that do not engage in spammy, misleading or sensational behavior"[20] including clickbait, Facebook does not clarify how transparency can be executed as a metric in making content decisions.

Much like the objectivity value has long been used as a strategic ritual in journalistic routines to defend the legitimacy of professional journalistic practices (Tuchman, 1972), the transparency value is deployed by Silicon Valley actors to legitimize their role in shaping public discourse. Like the objectivity value, for transparency to be recognized as a new norm that has impact on public understanding of knowledge, it needs to be transformed into rituals embedded in routines of practices that can be understood and accepted by the public (Karlsson, 2010). By elevating transparency to a new and desirable standard of practices, both AllSides and Facebook claim to perform the rituals of transparency to help them obtain public trust in their roles as legitimate public knowledge producers.

According to Karlsson (2010), transparency can take two forms: disclosure transparency and participatory transparency. Disclosure transparency is about opening the process of production and making routines discernable, while participatory transparency is about getting the audiences involved in the production. For AllSides and Facebook, the efforts of claiming transparency largely fail to achieve either disclosure transparency or participatory transparency.

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[19] Meta. (n.d.). *News content on Facebook.* Business Help Center. https://www.facebook.com/business/help/224099772719228

[20] Ibid.

In the case of AllSides, analyzing discourse on its websites reveals recurring claims about commitment to transparency, including methodologies about the media bias rating system[21], the editorial philosophy[22], ownership information[23], etc. However, examining these recurring claims across multiple sources including interview transcripts, observation notes, and document analysis reveal that AllSides fails to articulate and clarify specific processes, techniques, and contexts for which the governing algorithm and the rating process operate upon. Similar findings also apply to the case of Facebook, which also lacks the "discernable" routines required by disclosure transparency.

The second form of transparency, participatory transparency requires people from both inside and outside of these organizations to have chance to "monitor, check, criticize and even intervene in the process" (Deuze, 2005, p. 455). The access for outside inquiry and intervention is rarely available in practices of AllSides and Facebook. For example, as noted in my observation, AllSides lists community feedback as a rating method employed to generate media bias ratings. But the company also emphasizes that "our ratings are not determined by community votes or majority rule"[24]. Mastrine also echoes this point in the interview that community feedback "doesn't determine our bias ratings" (J. Mastrine, personal communication, May 14, 2021). The limited impact of outside feedback and lack of third-party oversight over rating results indicates a deficiency of participatory transparency in AllSide's practices. In

[21] AllSides. (n.d.). *How AllSides rates media bias*. AllSides. https://www.allsides.com/media-bias/media-bias-rating-methods
[22] AllSides. (n.d.). *AllSides editorial philosophy.* AllSides. https://www.allsides.com/about/editorial-philosophy
[23] AllSides. (n.d.). *Ownership information.* AllSides. https://www.allsides.com/about/ownership
[24] AllSides. (n.d.). *How AllSides rates media bias*. AllSides. https://www.allsides.com/media-bias/media-bias-rating-methods

addition, the absence of information about who comprises the "community" also signifies the scarcity of disclosure transparency.

The lack of participatory transparency also plays out in Facebook's public pledges to increase research access and empower independent researchers. As Wagner (2024) points out, the focus on increasing platform data access ignores the fact that platforms selectively share data with a limited number of researchers from specific fields, restricting new lines of inquiries and broader investigations. The lack of interview access for this dissertation attests to Facebook's opaque and limited research access. Meta also constantly makes changes to policies regarding research access, including the decision to end the service of widely used tools such as *CrowdTangle*, which allows researchers to track and analyze public content on platforms (Meta, 2024a).

The discursive prioritization of transparency value in practices of AllSides and Facebook reflect what Silicon Valley actors regard as key concern of building trust in public knowledge producers: the lack of transparency in knowledge production and dissemination process. The elevation of transparency value in Silicon Valley actors' practices embodies their efforts to reconstruct public expectations about who should serve as knowledge authorities. But for AllSides and Facebook, claiming transparency is mostly performative tactic aiming at legitimizing Silicon Valley actors' role in shaping the public discourse and their professional values.

Establishing Expertise

Establishing expertise is another key legitimizing strategy for social actors addressing climate disinformation. In the science community, questions about expertise are often associated with policing the professional boundaries of scientists, such as the access to scientific expertise

(Abbott, 1998). As climate science has become what Funtowicz and Ravetz (1993) termed "post-normal science", characterized by "facts uncertain, values in dispute, stakes high and decisions urgent", (p. 744), a broad array of expert voices needs to be included in the public discourse (Hulme, 2009). Epistemological uncertainty and ambiguity of science is a pivotal challenge in climate communication (Callison, 2014).

Faced with disputed facts and urgency of the climate crisis, it falls to the experts to provide the reassurance and credible knowledge to the public as society grapples with challenging decisions about prioritizing issues and allocating scarce resources (Jasanoff, 2005; Revkin, 2007). To tame uncertainty and defend professional boundaries, expertise is frequently cited to justify the exclusivity of scientists. Expertise, as a product of social order and knowledge, however, has always been shaped by various social, political, and cultural forces (Jasanoff, 2003). In the post-truth society, issues relating to expertise, such as who is considered an expert, who has the authority to present evidence, and who has the persuasive power to convince the audience, come under increasing public scrutiny (Hulme, 2009).

The epistemological challenges of the post-truth society also render expertise easily manipulated. For example, climate disinformation campaigns often use fake experts as a strategy to cast doubt on scientific consensus and public understanding of climate change (Cook, 2020). These fake experts can pose as arbiters of knowledge in the networked information environment and acquire amplified influence in the public discourse but lack recognized credentials and other markers of credibility. To weed out fake experts, the scientific community employs a set of professional norms, standards, and rituals to build authority in making knowledge claims and shield them from outside attacks of their professions. These norms and standards include committing to scientific objectivity and employing boundary policing criteria such as academic

credentials, records of conducting research, elections of professional societies, and the peer-review system (Collins & Evans, 2007; Hulme, 2009; Jasanoff, 2005).

Committing to Scientific Objectivity

Commitment to scientific objectivity has long been considered an indicator for reliable public knowledge. The belief that scientific claims, methods, and results should be independent from personal interests, biases, value judgements and withstand critical scrutiny is deeply weaved into scientific expertise (Jasanoff, 2005; Reiss & Sprenger, 2014). Claiming commitment to scientific objectivity is essential for scientist-led fact-checking nonprofits like Climate Central and Climate Feedback to maintain credibility as scientific knowledge producers. For these two organizations, commitment to objectivity is reflected in three aspects of their discursive efforts: claiming the centrality of science, claiming neutrality of policy position, and claiming autonomy and independence in decision-making.

First, both organizations place science-driven, science-based climate information as the centerpiece of their practices and emphasize on the guiding role of "the science". According to Girard, Climate Central positions itself as "active advocates for science and for listening to science" (P. Girard, personal communication, December 3, 2021). Similarly, Forrester explains that Climate Feedback's fact-checking centers on "a very scientific-driven process and a scientific approach". Forrester also underscores the centrality of science in organizational considerations for Climate Feedback: "We really do value science and that kind of comes above everything else… It's really important for us to use that and include the science in every review." (N. Forrester, personal communication, June 24, 2021). The centrality of science is also reflected on discourse of both organizations. Science Feedback, the parent organization of Climate Feedback describes its first mission as providing users with "access to scientifically sound and

trustworthy information".[25] Likewise, Climate Central also describes it mission as "communicates climate change science, effects, and solutions to the public and decision-makers".[26]

Second, Climate Central and Climate Feedback both highlight non-partisanship and non-advocacy as core organizational principles. Science Feedback highlights policy neutrality in their public statement about commitment to objectivity on its official website:

> Science Feedback is dedicated to science education and does not advocate for any particular policy, nor does it support any political candidate or party. Science Feedback ensures that our staff are not directly involved in political parties or advocacy organizations that could bias their neutrality and undermine their commitment to scientific accuracy.[27]

Policy neutrality is foundational to Climate Feedback's fact-checking practices, as Forrester argues in the interview, the "third-party" perspective grants the organization critical capacity to evaluate a wide range of knowledge claims: "We really try to be an objective third-party […] we have the capacity to evaluate and look at from a critical scientific perspective." (N. Forrester, personal communication, June 24, 2021)

Likewise, Climate Central also stresses that the organization is "policy- and technology-neutral" and lists "policy neutrality" as one of the core values of the organization on its website[28] As Girard points out in the interview, policy neutrality is "incredibly important" as it safeguards Climate Central's mission of effectively communicating climate science as a U.S. based climate

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[25] Science Feedback. (n.d.). *About.* Science Feedback. https://science.feedback.org/about/
[26] Climate Central. (n.d.). *About.* Climate Central. https://www.climatecentral.org/what-we-do
[27] Science Feedback. (n.d.). *Community standards and participation guidelines*. Science Feedback. https://sciencefeedback.co/community-standards/
[28] Climate Central. (n.d.). *Our approach.* Climate Central. https://www.climatecentral.org/our-approach

science nonprofit navigating a "highly divided" context in which climate science has been politicized:

> It's incredibly important to us, not to side with a policy, a politician, an industry, or a particular solution…Particularly in the US, in a highly divided country, politics can draw us away from effectively helping people understand what climate change means for them and what they can do about it… Policy neutrality enables us to provide a public service that the that protects everyone. (P. Girard, personal communication, December 3, 2021)

Third, both Climate Central and Climate Feedback claim scientific autonomy, which ensures scientists the right to make independent research decisions from science-driven perspectives. Forrester describes the community of scientists at Climate Feedback as "a pretty loose structure with a lot of independence". According to Forrester, scientific autonomy among the scientists facilitates robust research: "[…] people kind of taking on claim reviews that they feel comfortable tackling and then getting feedback from everyone else to make them stronger." (N. Forrester, personal communication, June 24, 2021).

Climate Central also claims scientific autonomy in their practices. As Girard mentions in the interview, when selecting outside organizations and researchers to work with, the organization prioritizes the applicability and validity of research:

> First and foremost is the research and its applicability to climate change and climate change communication… When we're working with outside organizations and outside researchers, it's less about their communication abilities than the importance and scientific validity of their work. (P. Girard, personal communication, December 3, 2021)

Employing Boundary Policing Criteria

Climate Central and Climate Feedback also reference scientific boundary policing criteria is to establish expertise as legitimate climate knowledge producers. These scientific boundary policing criteria, as indicated by previous research, usually include academic credentials, track record of achievements, relevant field experiences (Collins & Evans, 2007), and most import of all, the peer-review system (Hulme, 2009). Academic credentials, including academic degrees, professional titles, and institutional affiliations are featured on profile pages of editorial and research staff members of both organizations. For Climate Feedback, Forrester emphasizes that "almost all the editors have Ph.Ds." and "there is a fairly strong science background to almost everyone who works at the organization" (N. Forrester, personal communication, June 24, 2021).

Based on my observation, in a sample review by Climate Feedback, the job titles and professional affiliations of editors and contributing reviewers are usually listed along with their quotes. On a webpage about recruiting prospective scientist reviewers, Climate Feedback lists requirements include: "have a Ph.D. in a relevant discipline; have at least one published article in a peer-reviewed scientific journal within the last 5 years in the field they are commenting on."[29] In the reviewer application form provide by the website, Climate Feedback also asks for information about affiliation, fields/areas of expertise, and publication details[30]. In the case of Climate Central, I observed two board members listed as senior scientists affiliated with Princeton University. Five scientist staff members, with job titles ranging from climate scientist, computer scientists, senior scientist, senior advisor, and director of science all have Ph.D. degrees in science from prestigious U.S. universities.

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[29] Science Feedback. (n.d.). *Apply to become a reviewer*. Science Feedback. https://sciencefeedback.co/for-scientists/#ref

[30] Ibid.

In addition to academic credentials, both organizations also highlight achievements and field experiences of their member reviewers and editors. Climate Feedback notes on its website that "reviewers are chosen for their domain expertise, notably verified by having recently published articles in top-tier peer-reviewed science journals"[31]. For other team members without a Ph.D. in science, field experiences in science journalism and science education are listed as credentials in their profile descriptions. In the case of Climate Central, take the profile page of CEO and chief scientist Benjamin Strauss as an example, detailed information are provided about research expertise, media appearances, professional experiences, selected academic publications and impact, including statements such as "he has testified before the U.S. Senate"[32] and that "his past work has been cited by the White House and the Secretary-General of the United Nations."[33] For other scientists in the organization, past and current research projects, memberships and certifications from professional associations, and publication records are included in their profile pages.

For both organizations, academic credentials and achievements serve as restrictive boundary policing criteria to weed out pseudo-experts often used to discredit climate science in disinformation campaigns. However, among the boundary policing criteria routinely implemented by the science community, peer review is perhaps the most prominent mechanism. Based on observation, document analysis, and interviews, I suggest that the peer review system serves as the most important boundary policing criterion employed by Climate Central and Climate Feedback to establish scientific expertise. For example, on its website, Climate Feedback does not just require scientist reviewers to have a publishing record on peer-reviewed

[31] Science Feedback. (n.d.). *About.* Science Feedback. https://science.feedback.org/about/
[32] Climate Central. (n.d.). *Benjamin Strauss.* Climate Central. https://www.climatecentral.org/what-we-do/people/ben-strauss
[33] Ibid.

top tier academic journals; for every article review published on the website, multiple reviewers also cross-check annotations and compile references from prestigious journals such as *Nature*. Specifically, when describing guidelines for scientific credibility rating on its website, Climate Feedback determines that if an article or a claim fails to indicate the peer-review process is included in the research study, the best accuracy rating it can get in a five-point scale (-2 to +2) is 0, which stands for "neutral": "no significant errors, but not enough insight either to inform the reader"[34].

Climate Central also underscores the peer review mechanism in their practice. In a section on its website introducing "What sets us apart", Climate Central noted its "original, peer-reviewed scientific research"[35]. When asked about solutions to address climate disinformation, Girard stresses that it is important "to stick with the science and to stick with what we know to be reliable peer reviewed information" (P. Girard, personal communication, December 3, 2021). According to Girard, original and peer reviewed research is foundation of Climate Central's programs and the defining character of Climate Central as a science communication organization:

> The underpinning of all of it is original research and our ability as a scientific organization to identify important and trustworthy and influential peer reviewed research and then turn that into the foundational building blocks of the communications programs we develop… everything that comes from us is vetted peer reviewed science and that's absolutely critical. (P. Girard, personal communication, December 3, 2021)

[34] Science Feedback. (n.d.). *Process – How Science Feedback works*. Science Feedback. https://climatefeedback.org/process/

[35]Climate Central. (n.d.). *About us.* Climate Central. https://www.climatecentral.org/what-we-do

For Climate Central and Climate Feedback, peer review is not only a necessary mechanism to distinguish scientific expertise from misrepresentation and deception of pseudo-experts; it also serves to strengthening the validity of scientific research through maintaining "rigor, coherence, and integrity" of scientific knowledge (Jasanoff, 2010, p. 696). Forrester believes that Climate Feedback's ability to use scientific research on "published and reputable journals that are peer-reviewed" is the key to effective fact-checking (N. Forrester, personal communication, June 24, 2021). In fact, according to research by Graves (2016), journalistic fact-checkers often face outside challenges due to the "uninsulated" nature of the journalism profession, which lacks restrictive boundaries protecting their professional legitimacy from outside attacks. In contrast, findings in this analysis suggest that scientists-led fact-checkers like Climate Central and Climate Feedback have an advantage of citing boundary policing criteria such as the peer review mechanism to establish and defend their expertise of producing credible and rigorous scientific knowledge.

Capitalizing on Interactional Expertise

Indeed, boundary policing criteria such as credentials, track record, and the peer-review system all help reinforce the expertise of Climate Central and Climate Feedback in representing climate science. These boundary policing criteria are all associated with what Collins and Evans (2007) name as "contributory expertise", possessed by scientist experts who have formal education and training in the discipline and can contribute to research process in laboratory settings. According to Collins and Evans (2007), in contrast to contributory expertise is interactional expertise, which refers to the ability to speak the language of climate science through interactions with the scientific communities, without necessarily possessing the scientific research skills. Interactional experts are individuals who can converse naturally in the

language of the domain in the absence of skills to perform laboratory research, like sociologists and anthropologists. Therefore, interactional expertise provides the "social fluency" of acquiring tacit knowledge through engaging with the community without "bodily engagement" of the discipline (Collins & Evans, 2007, p. 90). To effectively communicate climate science to the public, Climate Central and Climate Feedback also capitalize on international experts such as professional journalists to bolster their expertise.

Climate journalists are well-poised to possess interactional expertise of speaking the language of climate science through closely interacting with the climate scientists. The interactional expertise of professional journalists can be bifurcated: journalists have specialties in not just interactions with the sources (scientists), but also and receivers (audiences) of the information (Reich, 2012). The bidirectional nature of interactional expertise of professional journalists gives them unique advantages in communicating climate science. For source-interaction, growing acquaintance with the climate research equips them with proficiency in climate science. For audience interaction, familiarity with the audience and their interests makes them a tangible and ubiquitous presence in the community, which can be effective in reaching and persuading local audiences (Reich, 2012).

Both Climate Central and Climate Feedback rely on the interactional expertise of professional journalists in disseminating scientific knowledge about climate change. On its website, Climate Feedback describes their mission as including "provide feedback to editors and journalists about the credibility of information published by their outlets"[36]. For Climate Feedback, providing review feedback to the journalists helps strengthen the accuracy of reporting, and in turn reinforce journalists' expertise of source-interaction in covering climate

[36] Science Feedback. (n.d.). *About*. Science Feedback. https://sciencefeedback.co/about/

science. Forrester mentions that their reviews may trigger journalists to double check sources and realize that “a sentence in a press release might have important context around it”, and incorporating the context can help readers “really understand the state of climate science today” (N. Forrester, personal communication, June 24, 2021).

Climate Central also cultivates and capitalizes on the interactional expertise of journalists. In Partnership Journalism program, Climate Central supplies data and analytics from the most recent climate research to local journalists, strengthening the depth and scope of climate reporting. According to Girard, partnering with experienced journalists and editors enables newsrooms to “cover topics in a depth that they otherwise couldn’t” (P. Girard, personal communication, December 3, 2021). More importantly, as Girard acknowledges, although Climate Central has its own communicative capacities, the audience interaction expertise of journalists is still indispensable in helping the organization achieve its mission:

> We absolutely want to be the most supportive voice for climate science, that we can be on our own certainly. but what we don't have the ability to do is leverage those voices through trusted members of communities as curators and gatekeepers, whom people have grown to trust and rely on to give them information that that affects them personally. (P. Girard, personal communication, December 3, 2021)

In fact, local journalists are not the only group of trusted messengers that Climate Central have invested on. In Climate Matters program, Climate Central invests in interactional expertise of local TV meteorologists as trusted scientists and messengers in their communities. As Girard points out, for many individuals, local meteorologists are “the only scientist that they encounter on a regular basis” and “the sole representation of a scientist in many people‘s lives”. At the same time, meteorologists are also “experts on their marketplace and their audiences”. For Climate

Central, these experts provide inputs that "enables us to explore and even commission research that helps them communicate with the people that trust them" (P. Girard, personal communication, December 3, 2021). Through investing on meteorologists and journalists of local media outlets, Climate Central capitalizes on these interactional experts to bolster their expertise in producing legitimate climate knowledge.

Scientists-led nonprofits are not the only social actors vying for establishing expertise as legitimate public knowledge producers. Silicon Valley actors such as AllSides and Facebook also employ discursive strategies to establish their expertise as purveyors of public discourse. But unlike scientist-led nonprofits relying on commitment to objectivity and scientific boundary policing criteria, for AllSides and Facebook, the efforts of establishing expertise in shaping public discourse are mostly focused on two aspects: challenging the epistemic authority of professional journalists in making knowledge claims and exploiting the abstraction of digital systems to bolster their own ability to centralize power.

Challenging the Authority of Professional Journalists

Traditionally, American journalists rely on their commitment to objectivity to maintain "jurisdictional" expertise to "objectively parse reality" (Schudson & Anderson, 2009, p. 96). Objectivity also serves as strategic ritual for professional journalists to defend their profession against outside attack (Tuchman, 1972). But objectivity has also been an increasingly contested professional norm. Researchers argue that the "view from nowhere" journalism has failed to serve public interest by perpetuating unequal power dynamics and dominating ideologies (Callins & Young, 2018; Fenton et al., 2020). Traditional outsiders of journalism like AllSides also target their critique of journalism on the objectivity norm. But unlike the internal critique of objectivity focusing on reforming and redefining the professional norm to better serve the truth-

seeking pursuit of journalism, AllSides challenges the epistemic foundation of journalistic objectivity and exerts its own imagination of epistemological pathway to truth: diversity of perspectives.

For AllSides, challenging journalistic expertise of purveying public knowledge sets the premise for establishing their expertise of building a media bias rating system that represents public information. AllSides's expertise of representing public information is contingent on the assumption that obtaining objective truth through the single knowledge authority of journalism is unattainable because of inevitable political biases presented in news media organizations. Instead, throughout its discourse, AllSides argues that the perceived media biases are measurable entities that can be rated, classified, and exposed through their diversity-of-perspectives approach. To justify this approach, AllSides argues that their media bias rating system provides diverse perspectives across the political spectrum that can help individuals "get the full picture and think for yourself"[37]. In addition, Mastrine emphasizes that the system "allows the media across the spectrum to act as a check on each other" and the cross-check system in between media outlets helps "misleading claims can come to light" (J. Mastrine, personal communication, May 14, 2021). However, examining these narratives exposes two underlying assumptions embedded in this diversity-of-perspectives approach. First, it assumes that average individuals, regardless of differences, are capable and motivated to parse disinformation from facts, given a variety of perspectives. Second, it also assumes that exposure to diverse perspectives leads to balanced, rational, and comprehensive understanding of social and political reality.

The diversity of perspectives approach in the media bias rating system manifests in AllSides's discursive construction of diversification in political bias of team members, funding

[37] AllSides. (n.d.). *Misinformation watch.* AllSides. https://www.allsides.com/misinformation

sources, and other demographic factors. In an article published on its website, Gable, the co-founder of AllSides emphasizes that having team members from left, right, and center makes a "political mix" that is "part of what makes AllSides great" (Gable, 2019). On its "Our team" webpage, the three co-founders of AllSides, John Gable, Scott McDonald, and Joan Blades are respectively identified as lean right, center, and lean left. John Gable's experiences of working for "President George H. W. Bush, Senator Mitch McConnell, and the Republican National Committee" and Joan Blades's experiences of co-founding "progressive groups Moms Rising and MoveOn.org" are cited as qualifications for coming across the political spectrum (Gable, 2019).

In addition, when describing funding sources and donors, the co-founder John Gable mentions that in the online article that some of its donors "have been active supporters in partisan politics on the left and right" (Gable, 2019). The two examples of sponsors across the political spectrum cited in the article include the "progressive" climate investor Tom Steyer and the conservative billionaire Charles Koch, whose foundation was known for funding climate disinformation campaigns discrediting climate science. AllSides also notes in "our team" page that they "look for diversity in gender, age, race, geography, religion, beliefs, background and more"[38] in team members and included a U.S. map marking geographical locations where team members are based. The diversity in political biases of team members and geographical locations where they are based, for AllSides, provides the organization the "diverse mix of experience and values" that justifies their expertise in representing credible, balanced media bias ratings.

[38] AllSides. (n.d.). *Out team.* AllSides. https://www.allsides.com/our-team

Exploiting the Abstraction of Digital Systems

For AllSides, the expertise of representing public information also lies in the abstraction of rating methodologies in the media bias rating system, which creates a hierarchy of media outlets by elevating the "Center" orientation as the desirable embodiment of trustworthiness and credibility. In the interview, Mastrine dismisses the idea that their media bias ratings facilitate such a hierarchy by rebutting the "misconception" about the superiority of a "Center" rating:

> "There's this misconception that we should only read media outlets that are rated 'Center' by AllSides because that means they are objective and balanced. But we always say that's not what that means. We think that 'Center' outlets still have a bias; they might omit certain perspective." (J. Mastrine, personal communication, May 14, 2021).

In an article published on the AllSides website, Mastrine (2019) emphasizes that a "Center" media bias rating from AllSides "doesn't necessarily mean a source is neutral, unbiased, perfectly reasonable or credible". Mastrine does acknowledge, however, that media outlets "would like to be rated Center" (J. Mastrine, personal communication, May 14, 2021). Mastrine also cited an incident when *The Daily Caller,* a right-wing media organization co-founded by right-wing political commentator Tucker Carlson reached out to AllSides, who has rated the outlet as "Lean Right" but wanted to change their rating to "Center". In fact, the request by *The Daily Caller* reveals the centralizing power of AllSides in calibrating the media bias rating system that renders the "Center" rating from AllSides an ideal for media outlets to be perceived as neutral and credible sources.

Despite the influence of their ratings, AllSides's media bias rating system remains an opaque "black box" mechanism. According to the description of rating methods on AllSides website, the editorial review is conducted by "a multipartisan panel of six or more people across

the political spectrum, with equal representation of people from the left, center, and right"[39]. However, AllSides only vaguely describes that panelists are "trained to spot common types of media bias"[40], without specific information about qualifications of these panelists, training protocols, exclusion/inclusion criteria in the review process. In fact, AllSides points out that "a formalized grading rubric to assess media bias" is intentionally avoided due to potential risks of rubrics introducing "unintended bias" and "fail to capture subjective elements adequately"[41].

Another rating method, the blind bias surveys is listed as "one of our most robust rating methods"[42]. AllSides provides a publicly accessible whitepaper document on its website describing the methodologies, sample survey contents, and results of the blind bias survey results from May 2022 (Mastrine et al., 2022). The descriptions of the blind bias surveys, however, omits the fact that the results are aggregated by algorithms designed and employed by AllSides. Using Internet archive Wayback machine, I recovered AllSides's claim in 2022 that the media bias ratings use "patented media bias detection and display technology to drive what is arguably the world's most effective and up-to-date media bias detection engine"[43]. But in 2024, examining the AllSides website reveals that language about the technology and algorithms is largely absent in descriptions about rating methodologies, except vague statements such as "we then calculate an average bias rating across all groups."[44] When asked about people behind the rating algorithm, the co-founder John Gable emphasizes that it is a product of "the entire team" and the

[39] AllSides. (n.d.). *About AllSides editorial reviews*. AllSides. https://www.allsides.com/media-bias/media-bias-rating-methods/editorial-reviews
[40] Ibid.
[41] Ibid.
[42] AllSides. (n.d.). *How AllSides rates media bias*. AllSides.https://www.allsides.com/media-bias/media-bias-rating-methods
[43] Accessed through archives by the Wayback Machine: https://web.archive.org/web/20220130142939/https://www.allsides.com/media-bias/media-bias-rating-methods
[44] AllSides. (n.d.). *How AllSides rates media bias*. AllSides.https://www.allsides.com/media-bias/media-bias-rating-methods

role of the team is to "run the system to avoid any one person, group or perspective having too much influence" (J. Gable, personal communication, June 7, 2021). The same ambiguity can also be found in AllSide's descriptions of AI technologies employed in generating "balanced news". In an article published on the AllSides website, Henry A. Brechter, AllSides's editor-in-chief mentions that "our editors are occasionally using AllSides-developed, artificial intelligence (AI) news tools" to help "automatically curate and create a first draft summary of top news articles for some stories" (Brechter, 2024). In another article, AllSides introduces "AllSides Bias Checker", an "AI-enhanced tool that instantly estimates news biases" provided with URL link to a news article. AllSides describes the tool as "innovative tool" powered by ChatGPT-4[45].

As Crawford (2021) argues, the abstraction of AI systems often obscures power dynamics in decision-making process embedded in these technical systems. Indeed, findings from this analysis indicate the abstraction, ambiguity, and omission in AllSides' discourse about algorithms and automated systems are intentionally designed and employed to serve AllSides's power in creating a hierarchy of media bias ratings that has potential impact on how public information is being represented. But AllSides is not the only tech actor who manipulates the abstraction of technical system to establish expertise in representing public knowledge. Facebook also uses abstraction of the automated system to claim expertise in shaping public discourse. When describing its fact-checking approach of combating climate disinformation, Facebook claims that they "utilize keyword detection to gather climate-related content in one place" (Meta, 2021b). However, Facebook falls short of explaining how the key detection technique works. The abstraction of technical systems also applies to Facebook's discourse about the fact-checking process. In a public document featured in the Meta Transparency Center, Facebook describes the

[45] AllSides. (n.d.). *Uncover bias with our new AI-enhanced bias checker tool: Try it now.* AllSides. https://www.allsides.com/blog/uncover-bias-our-new-ai-enhanced-bias-checker-tool-try-it-now

fact-checking process as “we use our technology to detect content that is the same or almost exactly the same as that rated by fact checkers”. As of March 2025, Meta updated the document adding its decision to end the fact-checking program in the U.S. but also emphasizes that “our technology can detect posts that are likely to be misinformation” in other countries (Meta, 2024b).

In addition to abstraction of automated systems, Facebook also frames the AI technologies deployed in its content moderation mechanism as new, efficient, and advanced. For example, in a public document about using AI to detect misinformation, Facebook identifies the AI technology used to scale the work of fact-checking partners as SimSearchNet ++, a “improved image matching model that is trained using self-supervised learning to match variations of an image with a very high degree of precision and improved recall” (Meta, 2020a). Facebook also claims that its deepfake detection model is “state-of-the-art” and the data synthesis technique can be “more robust” (Meta, 2020a). In these incidences, technological innovation and sophistication of AI technologies are used to justify Facebook’s expertise in curating and moderating a vast amount of public information on its platform. Narratives about disembodied technical innovations, however, are always imbued with existing values and systems of inequalities yet rarely acknowledged (Crawford, 2021).

On the other hand, Facebook also actively capitalizes on the experts to legitimize their decisions of sorting, ranking, and prioritizing certain climate information on its platform. In one of the key approaches to combat climate disinformation, the Climate Science Center, Facebook emphasizes that data and figures presented come from researchers affiliated with the Intergovernmental Panel on Climate Change (IPCC). In subsections featuring common key questions and facts about climate change, recognized organizations, and 1.5 C explained,

Facebook identifies data sources as trusted governing and research organizations such as IPCC, NASA, and the Yale Program on Climate Change Communication.

In public facing statements about its sustainability efforts, Facebook often emphasizes the effort of elevating the voices of trusted organizations as a key approach of dealing with climate disinformation (Meta, 2022b). These organizations, including Monash Climate Change Communication Research Hub, Cambridge Social Decision-Making Laboratory, and Yale Program on Climate Change Communication are all led by scientists in elite research universities. In the newly introduced feature of Climate Pledges in Facebook Groups, Facebook develops "expert-backed" climate action advice with United Nations Environment Program (UNEP) and UN Act Now (Meta, 2022c). Facebook also states that in countries where the Climate Science Center has not been made available, Facebook would "direct people to the UN Environment Programme when they search climate related terms on Facebook" (Meta, 2022b). Citing scientific expertise of these research organizations, for Facebook, helps justify its self-claimed efforts of combating climate disinformation on the platform.

It is worth noting that Facebook does not just rely on scientific expertise in legitimizing their efforts of addressing climate disinformation; journalistic expertise was also brought into play. In the section "In the Spotlight" of the Climate Science Center, Facebook features climate stories from mainstream news organizations and states that these contents are "selected by a team of experienced journalists at Facebook"[46]. Facebook does not just rely on news contents from legacy news outlets; it is also dependent on professional journalistic judgment in highlighting and presenting this media content. By highlighting research organizations and journalists in the process of selecting and presenting climate information, Facebook capitalizes on the expertise of

[46] Climate Science Center. (n.d.). Home [Facebook page]. Facebook. Retrieved January 14, 2025 from https://www.facebook.com/climatescienceinfo

the science and journalism communities to legitimize its role as a credible purveyor of public knowledge about climate change, while diverting public criticism away from its role in enabling and amplifying climate disinformation.

Demonstrating Practice

The interpretative strategies employed by social actors to establish expertise in shaping public discourse about climate change are largely performance-like strategies to navigate professional boundary disputes. For these actors, the demonstration of their work in various public settings is equally important as their efforts of building trust and establishing expertise. Public demonstration is a prominent aspect of establishing legitimacy in shaping the public discourse. With increasing public involvement in collective decision-making, not only the experts and their specialized skills and knowledge, but also their process of articulating facts needs to obtain credibility in the public eye (Jasanoff, 2005). These social actors, coming from distinct professional fields, vary in their perceptions of how they should be publicly demonstrating their practices.

In the science community, although the Mertonian "disinterestedness" norm has been a long running current shaping the policy-neutral ideal, researchers argue that maintaining such ideal is not always easy (Hulme, 2009), nor is it productive or socially responsible (Cloud, 2020). As Sarewitz (2004) argues, in presenting the complexity and richness of the nature, the science enterprise must rely on "methodological, disciplinary, and institutional diversity", which is deeply intertwined with a plethora of "competing, value-based political positions" (p. 386). Scientists, according to Pielke (2007), face the choices of roles they play in relation to policy and politics in modern democracies. Despite shared epistemological approaches in addressing climate disinformation, Climate Central and Climate Feedback, the two scientist-led institutional

fact-checking organizations, choose different roles that shape how they demonstrate their practices to the public.

Scientist Arbiter versus Broker of Policy Alternatives

Adapting the framework by Pielke (2007), which identifies four roles that scientists adopt in policy decision making: pure scientist, scientist arbiter, issue advocate, and honest broker of policy alternatives, I argue that Climate Feedback takes the role of scientist arbiter, while Climate Central adopts the role of broker of policy alternatives in demonstrating their practices to the public. According to Pielke (2007), scientist arbiter focuses on issues that "can in principle be resolved through scientific inquiry", while abstain from normative questions and political controversies (p. 16). In contrast, broker of policy alternatives explicitly "integrate scientific knowledge with stakeholder concerns in the form of alternative possible courses of action" (p. 17).

Climate Feedback's choice of taking the role of scientist arbiter is evident in their priority of choosing articles and claims to fact-check: "it has to be something that we feel like we can fact check effectively with science" (N. Forrester, personal communication, June 24, 2021). The criterion of selecting articles and claims to review is based on whether they consider the disputes and controversies in these articles and claims can be settled through scientific verification process. The role of scientist arbiter is also reflected in Climate Feedback's appeal process when interacting with news media editors, in which the organization takes up a formal and juridical procedure. Forrester mentions that the appeal process involves Climate Feedback responding to the appeal from editors and "let them know why we made the decisions that we made. In that they have an opportunity to issue a correction or an update if they would like to." (N. Forrester, personal communication, June 24, 2021).

Figure 1

Sample Simulation of National Mall Comparing Warming Scenarios by Climate Central

Climate Central's role as broker of policy alternatives can be seen most clearly from the program of Sea Level Rise, which uses data visualization techniques to simulate sea level rise scenarios under conditions of different temperature increases (See Figure 1 for a sample simulation). The program selects exemplary locations around the world and visualizes two

contrasting warming scenarios: 1.5 °C of warming (The Paris Agreement commitment of carbon reduction) and 3 °C of warming (current trajectory with carbon emission). By presenting the two contrasting warming scenarios (1.5 °C and 3 °C) with different possible course of actions (carbon emission reduction and unchecked carbon emission), Climate Central acts as a broker of policy alternatives to incorporate climate science into different policy options.

The role can also be recognized in Climate Central's localization approach of shaping individual perceptions and experiences of climate change to build foundation for policy choices and actions. In the interview, Girard explains that these visualizations of sea level rise scenarios, although showing "a distant future", but are about "local areas that people understand, encounter and care about". These localized visualizations, according to Girard, have a "meaningful long-term benefit in changing the pathway that we're taking in terms of emissions and the sea level rise" and eventually mobilize collective actions. Girard also stresses that "result from it was a way for us to again really localize something that could drive people to action and insights that they don't have." (P. Girard, personal communication, December 3, 2021)

The different roles taken on by Climate Central and Climate Feedback to demonstrate their practices to the public, identified in this research, likely reflect different cultural and social contexts of Europe and the United States in which institutional roles of science and scientists are publicly perceived. Public demonstration, as Jasanoff (2005) argues, is a culturally specific way of engaging citizens in different societies. America's open, pluralistic and contested public culture (Jasanoff, 2002) inevitably shapes how Climate Central, an science nonprofit founded by U.S. climate scientists perceive to be the priority of climate communication. Climate Central's emphasis on the "communicative" aspect of science communication, such as partnering with journalists and meteorologists reflects what Jasanoff (2005) regards as American cultural

assumptions of public decision making through procedures of deliberation and debates, while also relying on individual competence of comprehending and evaluating scientific claims being presented to them.

In contrast, the science arbiter role that Climate Feedback, a France-based organization takes is shaped by the authority of elite science in European societies where science holds "a more secure place in public esteem" (Jasanoff, 2005, p. 263). Many European nations have more centralized and expert-driven epistemic cultures where scientific advisory institutions are more closely integrated into the policy decision-making. Scientific authority is also less contested; and public trust in scientific institutions is relatively higher. Compared with their American counterparts, European scientists founded science nonprofits like Climate Feedback feel less pressure to constantly engage in public demonstration and persuasion to woo public support.

Visibility and Transparency

For Silicon Valley actors, demonstrating practices to the public are also crucial for establishing legitimacy. AllSides takes multiple measure to increase the organization's visibility. For example, the AllSides website includes an explicit "press" section. Based on my observation, the "press" webpage consists of press releases and announcements, highlighted press coverage, notable speeches, a running list of media coverage, press contacts and materials. I also noticed that on this page, AllSides compiles a publicly accessible press kit on Google Drive that contains readily available PR materials such as logos, photos, screenshots of products, and promotional videos[47]. These readily accessible resources clearly indicate AllSides's intention of increasing the organization's visibility in media coverage.

[47] Accessible through: https://drive.google.com/drive/u/0/folders/1dLeYx-b1K6qkEfJvUqLT9VUh51n1D4Qx

Besides press coverage, social media is another tool for AllSides to grow visibility and influence. In the interview, Mastrine emphasizes that it is “really important” for AllSides “to have a strong place on social media platforms” because of the prominence of these platforms in the public discourse:

> We post our headline roundups there where we show left center right headlines on the same story, and we do that on Facebook and Twitter as well. We see that is really important, just because that is where people's eyeballs are. (J. Mastrine, personal communication, May 14, 2021)

Social media platforms did help AllSides gain public recognition. In 2019, AllSides introduced a “Media bias chart”, which visualizes categories of well-known media outlets based on AllSides’s media bias ratings. According to Mastrine, who is the creator of the chart, the original intent was to “get more people to know about AllSides”. But once circulated on social media platforms, the chart drew attention from celebrities and social media influencers and successfully attracted spikes of online traffic driven to the AllSides website (J. Mastrine, personal communication, May 14, 2021). The success of the chart further solidifies the priority of social media virality metric in AllSide’s public demonstration strategies.

Another move of AllSides to increase public visibility and engagement is launching a mobile application (app). According to Mastrine, what’s unique about the AllSides app is its feature of push notification that enables users’ exclusive access to AllSides and increases users’ dependence on AllSides’s news summaries:

> When there is breaking news, we can make sure that the first thing that people see about that story is a balanced headline roundup. So they're not just getting it from CNN or Fox.

> They're actually getting it from AllSides. (J. Mastrine, personal communication, May 14, 2021).

AllSides's efforts of attracting press coverage, investing on social media, and increasing user dependence through the mobile app reflects a capitalistic market orientation. As a Silicon Valley entrepreneur-founded media company projecting influence in shaping public discourse, phrases like "market" and "product" are prevalent in AllSides's discourse. In multiple webpages and online articles, AllSides describes media bias rating system as its "product". In the interview, Mastrine refers to the media bias chart as "our number one piece of marketing content (J. Mastrine, personal communication, May 14, 2021). These phrases reflect AllSides's communicative strategies and design choices, which prioritize maximizing public visibility in the attention economy.

Demonstrating measures taken to combat disinformation is also an important aspect of Facebook's legitimizing efforts. From the "Meta Transparency Center", releasing annual "sustainability reports", to official releases updating Meta's approaches and progress on combating climate disinformation on their platforms, Facebook's parent company Meta has invested in convincing the public that their self-regulatory measures in addressing climate disinformation are effective. However, Facebook's approaches of addressing climate disinformation are mostly performance techniques to cover up deeper accountability problems of the platform. For example, Facebook cites the Climate Science Center as the most important approach for combating climate disinformation by claiming that it provides "one-stop resource available in more than 150 countries" for authoritative scientific information about climate change (Meta, 2022b). The Climate Science Center, however, appears to have minimal influence on climate-related information on the platform. Searching for the center on the Facebook in

November 2024 reveals that Facebook curated climate news stories featured on the center were most recently updated in September 2023. More importantly, it is unclear how Facebook factors in the Climate Science Center in their news feed algorithms dictating climate-related information flow. In fact, the lack of access to the process of self-regulatory measures is largely "by design", as previous research indicates, Facebook's employees are bounded by nondisclosure agreements and content decisions are often made behind closed doors (Caplan, 2023).

Over recent years, Facebook has been facing mounting political pressure from testifying to the U.S. Congress, updated legislation and regulation acts in Europe, and public revelations by whistleblowers such as Frances Haugen (Mac & Kang, 2021). Research has shown that growing public criticism has driven Facebook to move towards "enhanced self-regulation", by which Facebook reallocates content-related regulatory responsibilities to third-party intermediaries (Medzini, 2022). Examining public announcements about Facebook's approaches of addressing disinformation reveals that the platform consistently refers to their partnerships with third-party fact-checkers to label and verify climate-related information (Meta, 2021b; Meta, 2022b). In addition, the third-party fact-checking partnership has also been repeatedly referred to by the platform as a key measure to combat disinformation throughout the company's public narratives, most notably its CEO Mark Zuckerberg's multiple congressional testimonies (The United States Senate, The Committee on Commerce, Science and Transportation, 2020; The United States Senate, The Committee on the Judiciary, 2020).

Yet analysis of Meta's public documents also found that climate-related contents are neither a priority among Facebook's lists of issues for fact-checking[48], nor a content category for Facebook to implement keyword detection to detect group content for fact-checkers to review

[48] Meta. (n.d.). *Fact-checking policies on Facebook, Instagram, and Threads*. Business Help Center. https://www.facebook.com/business/help/315131736305613?id=673052479947730

(Meta, 2021b). In January 2025, Facebook's parent company Meta ended its third-party fact-checking program, effectively dismantling one of Facebook's key efforts to curb climate disinformation on its platform, albeit already weak. Indeed, multiple independent investigations of Facebook have shown that there has been a gap between the company's demonstration of self-regulatory measures aiming at curbing climate disinformation and the enforcement of these measures. For instance, in 2021, an investigative report by UK-based campaign Stop Funding Heat found that climate misinformation received 1.36 million daily views on Facebook, merely 3.6 percent of which was fact-checked and only a miniscule amount was directed to Facebook's own Climate Science Center (Stop Funding Heat, 2021). In another report by watchdog group Center for Countering Digital Hate (2022), Facebook failed to label approximately 50% of posts spreading climate change denial, specifically from sources identified as the "Toxic Ten", which are major contributors to climate disinformation on the platform.

Meanwhile, previous investigations also reveal that Facebook continues to profit from advertising revenue generated through climate denial and skepticism (Culliford, 2021). The platform generates revenue primarily through paid advertisements from oil and gas companies, industry-backed think tanks, and lobbying groups. As Russell (2023) argues, Facebook's feeble efforts of moderating climate contents need to be matched against the fact that the platform directly profits from climate disinformation through paid advertising. Findings from this research further verify that Facebook's demonstration of self-regulatory practices in climate-related content is largely a performance to appease critical scrutiny over the more fundamental cause of rampant climate disinformation on its platform: the business model that prioritizes private profit over public interest.

Conclusion

Establishing legitimacy is a central concern for social actors vying for shaping public discourse about climate change, because legitimacy grants epistemic authority and public acceptance to their specific knowledge ways. This chapter examines three major processes in which Climate Central, Climate Feedback, AllSides, and Facebook employ legitimizing strategies to gain public recognition and approval. Specifically, I focus on three processes: building trust, establishing expertise, and demonstrating practices. These processes reveal distinct perceptions about what credible and authoritative public knowledge should look like and how these knowledge claims should be "articulated, represented, and defended" (Jasanoff, 2005, p. 249). These socially and culturally specific perceptions vary across professional communities of scientists, technologists, and journalists. The varying perceptions determine what legitimizing strategies get to be prioritized by which actors to distinguish their practices from other competitors.

In the process of building trust, scientist-led nonprofits of Climate Central and Climate Feedback mainly focus on building partnerships with media outlets and contextualizing climate science. In contrast, Silicon Valley actors AllSides and Facebook privilege the transparency value in their practices. These different strategies reflect how civic epistemologies, the culturally specific knowledge-ways shape various social actors' perceptions about the key causes and solutions to declining public trust in knowledge production. While scientist-led nonprofits aim at restoring public trust in science and scientists through bridging the gap between scientific knowledge producers and scientific knowledge consumers, Silicon Valley actors attempt to reconstruct public expectations about their role as public information purveyors and normalize their professional values in public knowledge production and dissemination.

Civic epistemologies also shape how these actors engage in the process of establishing expertise. Climate Central and Climate Feedback emphasize their commitment to scientific objectivity, the use of boundary policing criteria such as peer-review system, and interactional expertise of journalists. In comparison, AllSides and Facebook invest in challenging the epistemic authority of journalists and exploiting the abstraction of digital systems. These different strategies reveal how culturally specific knowledge-ways between scientists and technologies shape understanding about what expertise is and how it should be represented. While scientist-led nonprofits reinforce boundaries of scientific knowledge by employing traditional, authority-based strategies of scientific validation and expert credentials, Silicon Valley actors seek to expand the boundaries of public knowledge production through challenging the epistemic authorities of gatekeepers and redefining methods of knowledge production.

Finally, how various social actors engage in the process of demonstrating practices also reflect culturally specific knowledge-ways grounded in their professional cultures and political contexts. Climate Central and Climate Feedback take on different roles in public demonstration, as the broker of policy alternatives and the scientist arbiter respectively. These different roles are shaped by the distinct social and political contexts of the United States and Western Europe in which institutional authorities of science and public engagement styles vary. The strategies of increasing visibility and demonstrating transparency by AllSides and Facebook also reveal market-driven and performative-oriented understanding of legitimacy, rooted in beliefs of voluntary disclosures rather than external regulation and oversight. Their narratives of transparency and openness, however, exposes limits of voluntary transparency, as it often covers up profit motives and lack of accountability.

The three processes in which Climate Central, Climate Feedback, AllSides, and Facebook establish legitimacy reveal that legitimacy is fluid, competitive, and adaptable, thus must be continuously constructed, defended, and adapted to different audiences, sociopolitical contexts, and media environments. The varying priorities of strategies employed by social actors reflect culturally specific perceptions about what legitimacy is and who gets to have legitimacy as public knowledge producers. Through examining how these legitimizing strategies are shaped by civic epistemologies of various professional groups, this research responds to the recent theoretical turn of addressing the "matter of concern" in social science research (Latour, 2004), which argues for a more constructive approach to understand the entanglement of facts with social, political, and ethical concerns. Rather than assuming legitimacy is granted when scientific facts are being presented, this research illuminates that the dimensions of legitimacy, including trust, expertise, and public demonstration are always articulated, contested, and negotiated within complexities of social, political, and cultural contexts.

More specifically, this research contributes to climate communication literature that argues for moving beyond conveying scientific facts and focusing on engaging with diverse cultural, political, and ethical ways of knowing and meaning making to foster more effective public engagement (Boykoff, 2019; Callison, 2014; Hulme, 2009). This chapter examines how various social actors articulate and represent legitimacy in ways that align with their values and cultural beliefs, whether through privileging transparency or promoting climate science through media partnerships. Understanding diverse approaches of establishing legitimacy helps us account for the cultural, ethical, and ideological differences when communicating climate science to the public and envision more inclusive and effective solutions to address climate disinformation.

In pursuit of legitimacy, social actors often emphasize boundary markers that distinguish their practices from other competitors. Scientists use peer reviews, empirical data, and academic credentials to reinforce boundaries separating their work from pseudo-science. Technologists often employ narratives about transparency and technological innovations to challenge existing boundaries of social knowledge production. Regardless of their efforts to demarcate differences, they all need to adapt to evolving information landscapes that shape how the public perceives as legitimate knowledge practices. They also share understanding that technology is an essential part for addressing climate disinformation. In fact, digital technology often serves as a boundary object that allows these actors to interpret differently for their communicative needs while also facilitating connection and negotiation. But how do these social actors leverage technology in their practices? Given the central role of technology in these practices, this question requires to be explained in further detail.

Chapter 3. Leveraging Technology

In September 2024, Climate Action Against Disinformation (CAAD), a coalition of organizations dedicated to combating climate disinformation published an investigation revealing that the platform design of Facebook is exploited by accounts promoting false and misleading narratives about climate change in the UK. The report highlights key tactics that climate disinformation agents employ to "game" the design of platforms like Facebook, including "taking advantage of the 'borderless' nature of social media" and "exploiting algorithms' preference for high-traction posts through upcycling the most effective content over and over" (CAAD, 2024). Indeed, as digital platforms become ubiquitous for climate communication and activism, its structural design also serves as critical architecture for enabling the dissemination and monetization of climate disinformation.

Despite rampant climate disinformation circulating on Facebook, the platform's response to address the problem has been lackluster. In 2022, an investigative report by the Center for Countering Digital Hate (CCDH), a UK-based watchdog organization focusing on combating online misinformation and harmful digital behavior analyzed climate disinformation on Facebook. The analysis shows that Facebook failed to label approximately half of content from leading outlets promoting climate denial, such as *Breitbart*, *the Daily Wire* and Russian state media (CCDH, 2022). Despite Facebook's pledges of attaching "information labels" to climate content and directing users to its own Climate Science Center (Meta, 2021d), climate disinformation is largely circulating unchecked on the platform. In January 2025, shortly before the inauguration of Donald Trump, Facebook's parent company Meta announced that it would end the third-party fact-checking program and instead rely on community users to flag controversial content (Kaplan, 2025). Facebook's shift in content fact-checking is expected to encourage more fossil fuel funded climate disinformation, disrupting climate science

communication, and obstruct public understanding of the climate crisis, in the name of free expression.

The fact that Facebook's content moderation decisions have significant implications on public discourse about climate change is indicative of a rapidly shifting information environment increasingly dominated by social networking giants. As Chadwick (2017) points out, the hybrid interplay among traditional media and digital media has disrupted traditional hierarchies of media power and reconstructed the public sphere. The disrupted communication flow among political institutions, media, and the public, along with declined trust in public institutions and the abundance of alternative information sources, creates conditions for strategic disinformation operations (Bennett & Livingston, 2018). Social media platforms, with underpinning logics of automation and algorithmic decision-making, largely transformed the structure of the public sphere through amplifying existing biases, reinforcing existing power relations, and facilitating fragmentation and polarization (Bucher, 2018; Pasquale, 2017).

Despite the increasingly prominent role that algorithms and big data play in shaping public discourse, social media companies tend to deploy the term "platform" in framing their operations. The term "platform", as Gillespie (2010) argues, allows social media companies to strategically downplay their own agency and obscure the political and cultural impact of technology through highlighting the misleading neutrality of the technical apparatus. The myth of neutral technical systems has also long been contested in the Science and Technology Studies (STS). Classification systems such as social media ranking algorithms function as infrastructures that enable and constrain the ways in which we organize information and arrange social relationships, and they are constantly shaped by social, political, and historical forces thus reflecting and reinforcing existing power structures and social orderings (Bowker & Star, 1999).

Both platform studies and infrastructure studies offer critical insights for examining the networked information ecosystem. Privatized platforms, designed, controlled, and benefited private commercial interests could be distinct from widely accessible and government funded public infrastructures (Plantin et al., 2018). But with increasingly ubiquitous social media platforms, Plantin et al. (2018) argue that we should adopt the bifocal lens to examine the processes of "platformization of infrastructures" and "infrastructuralization of platforms". That is, with an economy that prioritizes market competition and privatization, together with transformations brought by digital technologies, privately owned and deregulated platforms like Facebook and Google can compete for or even replace public social functions of previously monopolized infrastructures in shaping the way we communicate, access information, and interact with each other. Meanwhile, existing technical infrastructures are transformed into platforms that can be accessed and reconfigured by various third-party stakeholders, while remain proprietary monopolies subject to centralized control and exploitation.

In climate communication, widely used social media platforms such as Facebook are "infrastructuralized", becoming an integral part of communicative infrastructure that shapes climate science communication, activism, and policy discussion. Meanwhile, the "platformized" communication infrastructure enables fossil fuel funded climate disinformation operations, prioritizing misleading climate contents, amplifying the scale and reach of disinformation campaigns through algorithmic engagement metrics. While digital communication infrastructure enables climate disinformation to manipulate and exploit the material affordances of algorithm and platforms, it also provides new opportunities and diverse tools for scientists at Climate Central and Climate Feedback to identify and debunk climate disinformation, produce and disseminate science-based facts in more accessible and effective ways.

In fact, for social actors such as Climate Central, Climate Feedback, AllSides, and Facebook engaging in boundary work to establish their knowledge practices as potential solutions to climate disinformation, digital technology serves as a shared boundary object (Star & Griesemer, 1989), allowing for social actors to interpret, deploy, and translate across various culturally defined professional domains. Digital technology employed in these practices, from social media traffic tracking tool *CrowdTangle,* to algorithmic media bias rating system, provides the flexible capacity for various social actors to understand and adapt to their communicative needs in multiple settings. The "interpretive flexibility" of digital technology as a boundary object also raises new questions for these actors: What new sociotechnical conditions are made possible by digital technology to allow these actors to establish their professional practices? How do they leverage technological tools to achieve professional goals? What implications does interactions with technology have on their organizational norms, routines, and priorities? Examining these questions sheds light on our understanding of how digital technology shapes public knowledge production and dissemination processes. It also helps us critically reflect on how to arrange our interactions with technology to bring about healthy public discourse and collective decision making for social good.

In this chapter, I try to answer these questions by examining how social actors from various professional fields leverage technology to build practices addressing climate disinformation. Specifically, these actors include scientist-led organizations of Climate Central and Climate Feedback, Silicon Valley entrepreneurs founded media company AllSides, and social media platform Facebook. Digital technology has been central to how these actors define the nature of the problem of climate disinformation and arrange priorities in their approaches to addressing climate disinformation. In fact, the narratives surrounding technology in their

practices suggest various understanding that reveal assumptions about how public knowledge should be represented and how technology should be situated in our social and political life.

I adopt the mediation framework by Lievrouw (2014) to examine how social actors leveraging technology in their practices. The framework highlights the mutual shaping of technological tools and processes: *reconfiguration* of technological *artifacts*, *remediation* of communicative *practices*, and *reformation* of *social arrangements*. First, *reconfiguration* refers to the process in which artifacts, the technological material objects enable or constrain communicative actions. As technological objects, digital technology has reconstructed the public sphere through providing decentralized communicative networks for Climate Central, Climate Feedback, and AllSides to reach a vast number of potential audiences. At the same time, digital technology also creates economic incentives through datafication and automation to enable and constrain some communicative goals of these organizations. Second, *remediation* refers to the mutual process in which the communicative practices of humans are shaping and being shaped by their interactions with technological artifacts. Social actors such as Climate Central and Climate Feedback frequently use social media platforms as effective tools to engage with the public. Social media platforms, in turn, serve as critical communication infrastructures and shape the communicative choices and priorities of these organizations. Third, *reformation* is the process in which social arrangements, including patterns of relationships and organizing structures develop and evolve with artifacts and practices. As social actors increasingly interact with digital technology, new patterns of social relationships emerge, including partnerships built by digital platform Facebook and scientist-led fact-checking organization Climate Feedback.

The mediation framework provides an analytical lens to study mutually constituting elements of digital communication technologies: the material features of technological artifacts,

norms and values represented in the actions, and institutional power relations and cultural assumptions embedded in these articulations. In this chapter, I examine the three processes highlighted by the mediation framework and try to answer three major questions: what new sociotechnical conditions digital technology made possible for actors building practices to address climate disinformation? How do they leverage digital technology in their practices? What implications do interactions with technology have on these practices?

Reconfiguration of Artifacts

Lievrouw (2014) defines the process in which technological artifacts enable or constrain human actions as *reconfiguration*. In climate communication, digital technological tools not only transform the traditional modes of communication through digitizing the traditional news production process; they also provide new pathways for emerging actors to participate in the process of producing and disseminating climate information. For Climate Central, Climate Feedback, and Facebook, digital technology reconfigures the sociotechnical contexts to make their approaches of representing knowledge possible, publicly acceptable, even desirable. Specifically, I examine three ways digital technology reconfigures the sociotechnical contexts in which these practices situate: creating material conditions, economic premises, and social justifications.

Material Conditions

According to Castell's networked society theory, the advent of digital technology has reconfigured the networks of communication by shifting the structure and organization of information, rendering transformative power to digitized and networked media (Castell, 1996; Howard, 2011). The decentralized networks of communication offer looser and more flexible organizational forms, enabling individuals to challenge hierarchical power and coordinate

collective social actions (Benkler, 2006). In news production, decentralized digital technologies have democratized the way news is produced, distributed, and consumed by facilitating the transition from print media to digital media (Boczkowski, 2005).

Decentralized and non-institutionalized communication networks bring in multiple social actors like activists, NGOs, citizen journalists, and news startups, who were traditionally marginalized and underrepresented as legitimate news makers in the public sphere (Russell, 2011). In contrast to the news making practices of traditional news organizations, which is still bounded by existing power structures of ownership, concentration, and professional norms, networked communication technologies afford these emerging actors opportunities to connect, produce and distribute alternative forms of information flow to the public, rather than relying on mainstream media outlets to cover and amplify their messages (Russell, 2016).

For scientist-led nonprofits like Climate Central and Climate Feedback, widely available and low-cost decentralized digital technology reconfigures material conditions for them to produce and distribute information about climate science. Climate Feedback employs two technological tools that are central to their fact-checking and review process: a web annotation software *hypothesis* and a social media traffic tracking tool *CrowdTangle* provided by Meta. *Hypothesis*, the web annotation tool, is a free software built on open-source web principles[49]. The design and moderation of the software is a classic example of what Benkler (2006) describes as "common-based peer production", characterized by self-motivated individual participants, decentralized and self-disciplined community structure, and collective goals of producing public good. The annotation tool allows scientist reviewers to select, highlight, and annotate problematic claims with explanations backed by scientific research and data in a collaborative

[49] Hypothesis. (n.d.). *Current status*. Hypothesis. https://web.hypothes.is/accessibility/

way. Since 2019, *CrowdTangle* is provided to fact-checking partners like Climate Feedback to track and analyze the traffic and engagement of public content across platforms like Facebook and Instagram[50]. The functions of tracking and analyzing engagement metrics allow scientist reviewers at Climate Feedback to calibrate more effective strategies for increasing dissemination and visibility of their contents.

Similarly, Climate Central also employs various technological tools in their key programs. On its website, Climate Central introduces several data-driven resources that they use or provide to journalists for covering the climate impact. In Sea Level Rise program, Climate Central uses high quality visualized presentation to simulate impact of sea level rise on local and global landmarks. In the Partnership Journalism program, Climate Central supplies user friendly charts, graphics, and visual maps to local journalists to produce news stories about climate change. In the Climate Matters Program, Climate Central offers interactive maps and data visuals such as "Extreme Weather Toolkits" and "Climate Shift Index" to illustrate impact of climate change on extreme weather events and local weather (Climate Central, 2023). These technological tools help Climate Central translate abstract scientific data and findings into tangible visual scenarios accessible to average individual audiences.

Historically, nonprofit organizations and activist groups, especially the large and resource rich ones have relied on building connections with major news organizations to publicize their work (Fenton, 2010). The advent of digital technology, especially social media platforms make it possible for nonprofits and advocacy groups to produce and distribute news information, bypassing mainstream news organizations (Bennett & Segerberg, 2013; Powers, 2018; Russell, 2016). In fact, both Climate Feedback and Climate Central view social media platforms as

[50] As of August 2024, CrowdTangle is no longer available. Meta. (n.d.). *CrowdTangle.* Transparency Center. https://transparency.meta.com/researchtools/other-datasets/crowdtangle

important channels for publicizing contents and gaining public influence. In interviews, both Forrester and Girard point out that social media presence helps make their research available to a large number of potential audiences (P. Girard, personal communication, December 3, 2021) and direct more online traffic to their official websites for more detailed contents (N. Forrester, personal communication, June 24, 2021).

Decentralized digital communication technologies also introduce new dynamics shaping power relations in the information environment. In this "hybrid media system", news organizations increasingly rely on social media platforms to distribute content and reach the audience; while social media platforms increasingly get involved in the process of news production and dissemination (Chadwick, 2017). The prominence of social media platforms brought about new organizational dynamics for Climate Feedback and Climate Central. Unlike traditional scientist-led nonprofits that consist of mostly scientists, both organizations have employees specializing in digital media strategies. As of December 2024, based on my observation of website of Science Feedback, the parent organization of Climate Feedback, the organization employs a Communications Officer, who has background in "environmental journalism and the tech industry"[51]. Similar observation on Climate Central also indicates that the organization comprises professionals such as "Digital Content Manager" and "Technical Product Manager", who specialize in digital media and tech products[52]. These individuals with expertise in digital media technology made it possible for organizations to produce "highly collaborative" products such as data-driven visuals produced by Climate Central in Sea Level Rise program and Climate Matters program. According to Girard, these interactive and visualized maps and graphics could not have been made possible without collaboration of

[51] Science Feedback. (n.d.). *Team.* Science Feedback. https://science.feedback.org/team/
[52] Climate Central. (n.d.). *Team.* Climate Central. https://www.climatecentral.org/what-we-do/people

scientists and digital media specialists working at Climate Central (P. Girard, personal communication, December 3, 2021).

Economic Premises

With the rise of social media platforms, social information is transformed into quantified data, subject to extraction, tracking, and analysis (Mayer-Schönberger & Cukier, 2013). Data as a basic resource provides material foundations for most key features and functions of social media platforms. The ability to collect a vast amount of user data is foundational to the power of social media in personalizing contents, promoting engagement, and generating advertising revenue (van Dijck, 2013). Digital technology-enabled datafication has been normalized as a legitimate principle of accessing, analyzing, and monitoring online social behaviors (van Dijck, 2014). As datafication drives the business strategies and decision making for news organizations and tech companies, data has become the "regular currency" for the contemporary media economy (van Dijck, 2014, p. 197). Data as a form of capital drives the accumulation cycle of capitalism (Sadowski, 2019). Indeed, as Couldry and Mejias (2019) argue, a new social order of "data colonialism" forms through capturing and owning data resources. This resembles colonial extraction and exploitation, yet centers on transforming data resources for economic capital and political control.

In 2013, the Snowden leaks revealed the extent and intensity of NSA mass surveillance program in the daily lives of individuals. More importantly, the Snowden revelation highlighted the omnipresent surveillance technologies embedded in everyday communication infrastructures used by ordinary citizens (Denick & Cable, 2017). The incessant extraction and commodification of personal data embodies the dominant business model of "surveillance capitalism" that manipulates and monetizes private experiences at the cost of autonomy and privacy (Zuboff,

2019). By commodifying individual behavioral data, accumulation and marketization logics driven by datafication provide a viable economic premise for Silicon Valley actors to generate revenues and consolidating market control (Fenton, et al., 2020).

Extracting, analyzing, and profiting from data is the central logic underpinning practices of Silicon Valley actors, from social media giants like Facebook to media company AllSides. Facebook, the largest and most widely used social media platform in the world, has profited from its enormous user network by monitoring user activities, tracking personal data, and selling data for advertising revenues. In 2018, the Cambridge Analytica scandal revealed the scale of Facebook's predatory user targeting operations. The scandal brings public attention to Facebook's prominent role in micro-targeting and exploiting use data to influence political processes. The power of Facebook in shaping public discourse, including influencing who gets visibility and what constitute credibility in the online environment rests upon algorithms, the "encoded procedures" of processing data, tracking and predicting user preferences and behavioral patterns based on instructions (Gillespie, 2014, p. 167).

But algorithms are not just essential for social media platforms, it also drives AllSides's media bias rating system, which is built on the principles of big data extraction and algorithmic classification. The crowdsourced blind bias rating surveys collects free data input for building the algorithmic model. Meanwhile, according to the ownership information on its website, AllSides also generates revenue from targeted online advertising, which provides about 4% of AllSides's revenue in 2022[53].The personalized ads are generated based on algorithmically processed and categorized user data from browsing history, search queries, and past online behaviors. In fact, the ownership disclosure also shows that the majority of AllSides's revenue

[53] AllSides. (n.d.). *Ownership information.* AllSides. https://www.allsides.com/about/ownership

(about 72%) comes from "client services" of data analysis provided to partners in news, education, non-profit[54]. As a company selling data-based services as products, the ability of collecting, datafication and surveillance technologies make it possible for AllSides to collect, analyze and profit from user data.

Social Justifications

Meanwhile, digital technology has also reconfigured public perception about what constitutes legitimate public knowledge and how it should be represented in public discourse, providing social justifications for Silicon Valley actors to shape public knowledge production. In the long-standing tradition of journalism, journalists served as gatekeepers of public information, exercising professional journalistic judgment shaped by standardized routines, occupational norms, and organizational structures (Gans, 1979; Tuchman, 1972). The growing prominence of social media platforms in shaping the information environment challenges the legitimacy and authority of journalists as gatekeepers of public discourse. It also shifts understanding of legitimate representation of public knowledge, opening the door for Silicon Valley actors to exert influence on public discourse, such as AllSides and Facebook.

Under the surveillance capitalism, social relations are extractive; quantity of information is prioritized over quality; detecting patterns and predicting outcomes based on personalization and classification become routine acts (Fenton, et al., 2020; Denick & Cable, 2017). Indeed, as datafication legitimizes the capitalistic practices of data extraction with unprecedented scope and scale, it is normalized as the new paradigm and ideology for science and society (van Dijck, 2014). Datafication reshapes epistemological and ethical foundations of social knowledge production through challenging fundamental assumptions about the constitution of social

[54] Ibid. See also: AllSides. (n.d.). *AllSides Services*. AllSides. https://www.allsides.com/services

knowledge and the process of knowing and representing reality (boyd & Crawford, 2012; Crawford et al., 2014). Datafication also redefines the nature and forms of social knowledge by privileging algorithmic objectivity and normalizing the logic of classification and prediction associated with algorithm and automation.

In data-driven platform practices, data is treated as more than a currency, but a neutral technical artifact, free from human biases, values, and interests (Fenton, et al., 2020). Tech companies use data-driven algorithms to collect and analyze user data and predict patterns label themselves as neutral carriers of information. Algorithms, often treated as "black boxes" due to its opacity and complexity, are used to justify the automated decision-making outcomes as objective, impartial, and neutral (Pasquale, 2015). Datafication has made it possible for tech companies to privilege certain forms of knowledge and social order (Fenton, et al., 2020; van Dijck, 2014). Most prominently, algorithmic objectivity is prioritized as a legitimate principle for knowledge broking (Gillespie, 2014). Based on analysis of public documents and my observation of the website, Facebook's key approach to address climate disinformation on its platform involves the keyword detection technique, powered by algorithms (e.g. Meta, 2022b). Algorithms provides an easy-to-implement automated mechanism to detect and classify climate related content. The assumption of algorithmic objectivity provides justification for Silicon Valley actors, such as tech giants Facebook to legitimize their roles in shaping public knowledge production. Algorithmic objectivity also makes it possible for smaller players like AllSides to claim their organization as a legitimate and disinterested knowledge purveyor offering data-based services, including the algorithmic driven media bias rating system.

The assumption of algorithmic objectivity also normalizes algorithmic decision-making based on logics of classification and prediction in producing and organizing public knowledge.

Algorithmic classification and prediction assume complex social realities can be quantified and reduced to extracted data, which transforms to seemingly objective outcomes, allowing technical systems to centralize power through algorithmic decision making (Crawford, 2021; Fenton, et al., 2020). Examining narratives about AllSides's algorithmic media bias rating system shows that these narratives embody logics of classification and prediction through quantifying and categorizing "political biases" of media outlets as measurable entities. These embedded logics allow AllSides to project itself as legitimate purveyor of public information. Similarly, Facebook's content ranking algorithm also tracks, collect, and categorizes user data, excluding and prioritizing certain types of information over others, and enables power and politics of visibility and invisibility in "programmed sociality" that is "ordered, governed, and shaped" by algorithms (Bucher, 2018, p. 8).

Remediation of Practices

According to Lievrouw (2014), the process of remediation involves how technological artifacts shape practices of users and how users engage with the technological devices and systems. As Winner (1980) suggest, there are two ways in which power and authority are enabled and constrained in technological artifacts: the design and structure of the technical system that artifacts are embedded in and the inherent materiality of the artifacts. To understand how the remediation process manifests in practices of social actors addressing climate disinformation, I examine two aspects: how design of infrastructures shape practices of addressing climate disinformation and how material properties of technological tools influence these practices. For the infrastructure aspect, I examine how issues relating to labor, industry logics, and cultural practices are shaping practices of addressing climate disinformation. As Bowker and Star (1999) suggest, uncovering the seemingly mundane and routine infrastructural system requires

"infrastructural inversion", breaking down the underpinning labor, power relations, choices and standards.

For scientist-led profits Climate Feedback and Climate Central, using social media platforms in their practices reveals considerations of both the physical arrangements of the communication infrastructure and the inherent material properties of platforms. As social media platforms become increasingly integrated in our everyday social interactions, they serve as critical infrastructure for public communication. In interviews, informants from both organizations recognize the significant role of the "infrastructuralized" social media platforms in enabling the spread of disinformation. Forrester, the Science Editor at Climate Feedback believes social media plays a "huge role" in how climate disinformation spreads because false information "gain a lot of traction through social media, because a lot of that content is difficult to publish in the more mainstream media outlets" (N. Forrester, personal communication, June 24, 2021). Girard, the Director of Communications at Climate Central also noted that social media platforms provide a unique environment for climate disinformation to proliferate: "I rarely see what you think of as mainstream media outlets openly communicating disinformation. Obviously, that's not the same as social media where you've got multiple virtually infinite contributors." (P. Girard, personal communication, December 3, 2021).

But as Forrester points out, social media platforms are like a "double edge sword" for their practices. While platforms are "cause a lot of troubles" by amplifying climate disinformation, they also help Climate Feedback "get information up there" for effectively countering climate disinformation (N. Forrester, personal communication, June 24, 2021). Indeed, observations on social media accounts of both Climate Feedback and Climate Central show that both organizations routinely use social media platforms for publicizing contents.

Maintaining active social media presence is not a choice but a necessity for both organizations to reach audiences, as social media platforms effectively serve as the communication infrastructure for individuals to receive news information. In the interview, Forrester acknowledges that maintaining presence on widely used platforms are important for Climate Feedback because "a lot of people get their news from Facebook and Twitter and TikTok and all these platforms" (N. Forrester, personal communication, June 24, 2021). Girard also noted in the interview that having accounts on widely used social media platforms helps Climate Central reach potential audiences by making their research readily available: "[…] Particularly on Twitter and Facebook we've got accounts, where we want to make sure that our research is available and probably more importantly the visualizations that grow out of them." (P. Girard, personal communication, December 3, 2021).

Indeed, previous research has indicated that the ubiquity, scalability, and temporality of social media platforms make them vital media infrastructures (Plantin & Punathambekar, 2019). Meanwhile, social media platforms also possess unique material properties that shape how Climate Feedback and Climate Central consider priorities, represent scientific knowledge, and engage with audiences. Climate Feedback uses the Meta owned data analytics tool *CrowdTangle* to track the speed and impact of climate disinformation claims circulating on Facebook. The virality of a claim, according to Forrester, plays "a really big part of what determines whether we're going to evaluate something or not" (N. Forrester, personal communication, June 24, 2021). Virality, a material affordance of social media platform that allows content increase its reach and impact, has been an important consideration for Climate Feedback to select what claims and articles to review and prioritize these selections in their fact-checking: "Those [metrics] will indicate to us which claim should have priority, because if something [is]

spreading really, really quickly and appears to be false, [they] should take priority over other things that may be less viral…" (N. Forrester, personal communication, June 24, 2021).

Material dimensions of social media platform also influence Climate Central's considerations in using data visuals as a primary communicative strategy to interpret climate science to the audience. As Girard points out, the motivation behind creating visualizations is "because it's impactful on social media and it's easy to understand and quick to embrace" (P. Girard, personal communication, December 3, 2021). Additionally, when producing and distributing climate science data visuals to partner journalists, Climate Central also accounts for the multi-platform applicability of these materials, indicating the material properties of social media platform as important considerations in their communicative strategies. Recognizing that "the platforms that journalists use to communicate have become more and more complex", Girard emphasizes that they try to "make sure that the material that we release and the help that we give journalists is applicable across all of those channels" (P. Girard, personal communication, December 3, 2021).

Like Climate Feedback and Climate Central, AllSides also recognizes the level of use and indispensability of social media's infrastructural nature in daily communication and information consumption. Julie Mastrine, the Director of Marketing at AllSides explains in the interview that it is "really important" for AllSides to "have a strong place on social media platforms" because social media is "where people's eyeballs are" (J. Mastrine, personal communication, May 14, 2021). The infrastructural nature of social media platforms is also reflected in its scalability of reaching potential audiences. As Mastrine points out, even though their traffic still mostly comes from the directly typed in website address and Google search directed results, AllSides is "increasingly seeing that a lot of people finding out about us through social media" (J. Mastrine,

personal communication, May 14, 2021). The seeming indispensability, high level of use, and potential to reach the scale of audiences, together comprise the infrastructural features of social media platforms (Plantin & Punathambekar, 2019).

Despite considering infrastructural components of social media platforms, AllSides also actively leverages the material properties of platforms for communicative goals. Since 2019, AllSides has been publishing the AllSides media bias chart, a visualized chart categorizing popular media outlets based on AllSides's media bias ratings. The media bias chart has been, according to Mastrine, "our number one piece of marketing content", resulting in "huge spikes in awareness and knowledge of AllSides". In fact, Mastrine highlights shareability on social media as the primary drive to create the chart: "I had seen some other groups do this (charts) and I thought that this would be the perfect way to package our content to actually make a graphic that people could just easily share." (J. Mastrine, personal communication, May 14, 2021).

As a key social media affordance, shareability enables contents to disseminate across user networks. For AllSides, the success of the chart is also reflected on how it is being shared among highly visible individuals on platforms, as Mastrine mentions that "people with very prominent social media influencers were sharing it" (J. Mastrine, personal communication, May 14, 2021). In addition to leveraging shareability of social media platforms, AllSides's also develops its own mobile application. According to Mastrine, the motivation for developing the mobile app is providing a way for users to "get balance news more easily in a mobile friendly format" (J. Mastrine, personal communication, May 14, 2021). On its website, AllSides describes the app as "the only news app you'll ever need" to get news from popular media outlets "all in one place".[55]

[55] AllSides. (n.d.). *Apps & extensions.* AllSides. https://www.allsides.com/apps-extensions

For AllSides, investing and developing its own mobile app reflects considerations of material properties of mobile applications such as accessibility, connectivity, and ownership. Even though managing social media accounts could help attract numerous potential users, all content creators are subject to the filtering and ranking mechanism of platform algorithms. An AllSides owned mobile app therefore provides a convenient, readily accessible way to connect users, allowing AllSides to circumvent platform algorithms and promoting user "stickiness" (Brinberg et al., 2022). In addition, AllSides lists and endorses selected app and extension service providers that adopts its media bias ratings on its website. The cross-pollination effort among different apps and channels also helps facilitate exposure and connectivity of content and services provided by AllSides.

Social media platforms are not the only infrastructural component in AllSides's practices. As the central piece of AllSides's practices, the algorithm-driven media bias rating system serves as the infrastructure for services and products AllSides provides. AllSides adopts several rating methods to generate its patented media bias ratings, including editorial review, blind bias surveys, independent review, third-party data, and community feedback. However, aggregating data collected from these methods and generating outcome ratings relies on the algorithm developed by AllSides. As AllSides's "most robust rating methods", the blind bias surveys rely on participants recruited through "email campaigns and homepage on AllSides' website" (Mastrine et al., 2022). In a publicly accessible whitepaper about "Blind Bias Survey Results", AllSides identifies a total of 1345 respondents who participated in the surveys between May 24, 2022, to June 2, 2022. The demographical information of these participants, however, was not provided in the report. It was also unclear if these respondents received any forms of compensation from AllSides for their participation. For community feedback, another sourcing

method for producing media bias ratings, AllSides users are invited to vote on the published rating results on its website, but it is unclear whether crowdsourced community feedback providers receive any compensation for their participation.

As AllSides generates majority (72%) of its revenue from selling data analytics services resulted from these media bias ratings[56], it raises questions about the invisible digital human labor behind the system. The participation of recruited survey respondents and community feedback providers are both important contributors to AllSide's profitable data services, but it was unclear if these crowdsourced users are adequately informed of the financial value of the input they provide. An important question to ask is whether AllSides profits from the "abstract modes of exploitation", where the wealth generated from crowdsourced user data remain unobtrusive and without informed consent of its contributors (Andrejevic et al., 2014).

The issue of labor is not the only concern in the infrastructure of AllSides's media bias rating system. AllSides used to tout its media bias rating system as employing the "patented media bias detection and display technology"[57], which drives "arguably the world's most effective and up-to-date media bias detection engine"[58]. In fact, the logic behind the media bias system is essentially algorithmic classification. Classification systems shape decisions about standards and norms yet are often kept invisible. AllSides' media bias ratings use standardized quantification to classify political biases of media outlets into five simple and arbitrary categories: Left, Lean Left, Center, Lean Right, and Right. Although Mastrine acknowledges in the interview that "politics is more complex than a five-point scale", algorithmic classification

[56] AllSides. (n.d.). *Ownership information.* AllSides. https://www.allsides.com/about/ownership
[57] Accessed through archives provided by the Wayback Machine: https://web.archive.org/web/20220130142939/https://www.allsides.com/media-bias/media-bias-rating-methods
[58] Ibid.

provides a model to “put groups of ideas and ways of thinking into shorthand” in their ways of representing public knowledge (J. Mastrine, personal communication, May 14, 2021).

The embedded assumption of technical neutrality in algorithmic classification models allows AllSides to produce seemingly objective rating results. In fact, the assumption of technical neutrality permeates AllSides’s narratives about their practice. Mastrine describes the role of AllSides as a “map” that helps people to “get oriented in the landscape” of media information. She also mentions that AllSides “sort of see ourselves as a technology service that helps people to actually filter information and get views from multiple perspectives. So we're like a tool.” (J. Mastrine, personal communication, May 14, 2021).

The map, technology service, the tool—the instrumental interpretation of algorithmic classification system reveals underlying assumptions about data being purely technical and technology being inherently neutral, objective, and value free. Algorithm driven decision-making is then presented as a solution to human biases and value judgements, based on automated calculations and scores. Today, researchers recognize that machine learning systems structured by algorithms have been utilized by social institutions in allocating resources and making institutional decisions shaping living experiences of social and individual groups (Benjamin, 2019; Noble, 2018). Yet algorithmic decision making, powered by pattern recognition, classification, and predication is anything but neutral. The data driven outcomes of the algorithmic decision-making reveal patterns of social hierarchies, biases, and inequality, further exacerbating marginalized racial, ethnic, and gender minorities (Benjamin, 2019; Eubanks, 2018; Crawford, 2021; Noble, 2018; O’Neil, 2016).

In line with insights from critical algorithm research, AllSides’s five-point scale categorization of media bias can be seen as an algorithmic decision-making system that

generates seemingly objective results with embedded assumptions of technical neutrality. But in fact, these obscured, taken for granted decisions are laden with value judgements. As Crawford (2021) points out, the framing of "purely technical" infrastructures obscures the political choices embedded in them and "naturalize a particular ordering of the world" to justify these choices. AllSides's algorithmic media bias rating system normalizes measuring, sorting, and ordering of public information and justifies its ideologies, values, and political interventions. Algorithmic classification reduces and quantifies highly contextual and complex socially phenomena such as "media bias" and sorts them into arbitrary and fixed categories, procuring centralizing power for AllSides to justify its own version of social knowledge production. By framing its practice as a neutral technical "tool" and "map" its public-facing narratives, AllSides produces a socially influential infrastructure in shaping public perception of media information on important social and political issues, while justifying its own biases and agenda.

Like AllSides, the assumption of technical neutrality is also pervasive in Facebook's narratives around algorithm and artificial intelligence. As one of the most widely used social media platforms in the world, Facebook has evolved into "infrastructuralized" platform for public communication (Plantin & Punathambekar, 2019). According to Plantin and Punathambekar (2019), the fact that Facebook's role serves as the de facto infrastructure can be seen from the Facebook Zero initiative, which allows non-smartphone users to access the simplified version of Facebook bypassing the telecommunication data usage, thus becomes the equivalent of Internet access for millions of users in developing countries (Plantin & Punathambekar, 2019). Facebook's dominant market power and indispensable network scaling advantages is inseparable from its role in enabling networked propaganda and strategic manipulation of disinformation to gain astronomical impact (Benkler et al., 2018).

Despite the power of Facebook's infrastructure, the discursive strategies it employs to frame its approaches of combating climate disinformation echoes the logic of technical neutrality. The logic manifests in two forms: the abstraction of technical systems, which obscures material conditions under which these automated decisions are made; and the "lingua franca of innovation" (Benjamin, 2019), which normalizes decision making power of technical systems. On one hand, Facebook refers to the algorithm it employs to detect misinformation in partnering with fact-checkers vaguely as "our technologies" in multiple public statements (Meta, 2021b; Meta, 2022d). Facebook also describes AI as "a crucial tool" for addressing challenges of misinformation (Meta, 2020b).

However, the abstraction of algorithms and AI obscures the fact that these technical systems are heavily dependent on human "ghost work" labor in training, labeling, and verifying data sets and models (Gillespie, 2018; Gray & Suri, 2019). In fact, Facebook's content moderation involves methods of community flagging and automated detection. Both methods rely on "invisible and mundane" human labor of flagging and labeling (Gillespie, 2018, p. 136). Facebook's AI technologies in helping scale the work of fact-checking partners involve human labor to label training data and improve the prediction of the model. Yet the abstraction of technical systems conceals the exploitation of human labor and subjugation of users to algorithmic power and control (Mühlhoff, 2020).

On the other hand, Facebook uses "lingua franca of innovation" to frame its algorithms and AI technologies. As Benjamin (2019) argues, "lingua franca of innovation" such as "efficiency" and "progress" is often cited to create the "technological lures" of seemingly objective technical systems (p. 72). The "lingua franca of innovation" employed by Facebook can be seen from its description of AI technologies employed to scale the work for fact-checkers,

which is referred to as “SimSearchNet++,” an image matching model with “extremely high precision” and “effective at grouping collages of misinformation”. It can also be found in highlighted language processing technique of “LASER”, which allows Facebook to “more accurately evaluate semantic similarity of sentences” and “GoG”, a “more robust” deepfake detection model (Meta, 2020a). While acknowledging “there’s much more work to do”, Facebook also reinforces the progress and efficiency of their AI research in its public facing narratives: “But AI research is advancing rapidly and we are getting better and better and taking these new technologies and putting them to use quickly” (Meta, 2020a).

Indeed, analysis of Facebook’s narratives of abstraction and innovation around algorithms and AI reveals that Facebook is able to normalize logics of algorithmic classification and prediction as deterministic ways of governing social life through deploying these narratives, therefore consolidating its power in “the epistemological flattening of complexity” (Crawford, 2021, p. 213). The centralizing power, according to Ricaurte (2022), also grants legitimacy to Facebook’s invisible infrastructure in mediating social arrangements among technology, institutions, and individuals. As Gillespie (2018) points out, digital platforms today are serving as “custodians of the Internet”, moderating the public discourse, setting norms and rules, categorizing content, and judging the visibility of information.

At the core of Facebook’s infrastructure is the governing power of directing the information flow and engineering user participation, particularly making judgments about visibility and invisibility of published content (Bucher, 2018). Based on my observation and analysis of public documents, Facebook’s measures of mediating the visibility of climate content include directing users to Climate Science Center to learn about topics relating to climate change (Meta, 2021c); “significantly” reducing the distribution of content labeled by fact-checkers as

false (Meta, 2021b); and highlighting climate activists and advocates on their platforms during significant climate events like the UN Climate Change Conference (Meta, 2021a). These measures are all parts of Facebook's key mechanism for exercising power and control through forging a "regime of visibility" that poses constant "perceived threat of invisibility" to participants posting information content on its platform (Bucher, 2012; Bucher, 2018).

Platforms like Facebook increasingly serve as rule makers: to pursue influence, content publishers need to interpret the algorithmic architecture and "play the visibility game" set by platforms (Cotter, 2019). Findings from this analysis shows that organizations such as Climate Central, Climate Feedback, and AllSides all have to participate in the visibility contest and anticipate what content gets promoted by Facebook's algorithm to reach their communicative goals. But findings also indicate that Facebook's decisions about climate-related content fails to match up with its promise of promoting climate science and elevating the visibility of climate activists. These findings corroborate previous investigations about climate scientists and activists being censored, silenced, and blocked on Facebook (Milman, 2020; Waldman, 2020). Indeed, this research reinforces research on the role of digital platforms as a double edge sword for social actors engaging in climate communication (Russell, 2023). The platformized infrastructure of Facebook both provides opportunities for potential connection and visibility while also posing obstacles and threats for these social actors.

Reformation of Social Arrangements

According to Lievrouw (2014), social arrangements, such as patterns of relationships, organizing structures and institutional processes form, develop, and adapt to technological systems and practices through the process of reformation. As social actors using technological means to address climate disinformation increasingly interact with technologies in their

practices, new patterns of social relationships, institutional norms, and organizational dynamics start to emerge. For scientist-led nonprofits Climate Feedback and Climate Central, interactions with technologies have shaped their perceptions of how to effectively address climate disinformation. As scientist-led organizations, communicating climate science to the public does not just require getting the scientific facts accurate; it also calls for rethinking about strategies and priorities in their practices to better adapt to the shifting information environment (Boykoff, 2018; Priest, 2016). Engaging with the public and communicating climate science to the public increasingly requires better understanding of the media infrastructure (Callison, 2014).

As Cammaerts (2012) points out, activists of social movements are becoming more conscious of the "mediation opportunity structure", through which they use their knowledge of how media and technologies operate to leverage opportunities for shaping communicative actions. Both Climate Central and Climate Feedback actively leverage the networked opportunities facilitated by social media platforms to shape their choices and priorities in producing scientific knowledge and engaging with the public. The fact-checking priorities of Climate Feedback are largely dictated by platform engagement metrics like virality. Likewise, considerations of visibility and multiplatform adaptability also permeate media content and data visuals produced by Climate Central. These communicative priorities and choices of leveraging social media platform dynamics attest to the fact that scientists, like activists, are becoming more aware of the mediation opportunity structure in shaping public discourse about climate change. In the networked information environment, scientist-led nonprofits like Climate Feedback and Climate Central need to translate and represent their scientific expertise in a fast-changing arena of competing interests, ideas, and policies shaped by digital technologies (Callison, 2014).

While recognizing the opportunities provided by platforms for building connection and amplifying impacts of research, both Climate Feedback and Climate Central are aware of the grave challenges posed by platforms in effectively addressing climate disinformation. Both organizations highlight the capability and accountability of social media companies in addressing climate disinformation. In the interview, Girard mentions that one of the most effective methods to address climate disinformation comes from platforms: “I would say, one of the areas that you might see amazing tremendous immediate improvement is the platforms themselves policing their own content.” In fact, Girard believes that it is entirely within the power of platforms to stop the circulation of disinformation: “Certainly the platforms could stop it tomorrow if they chose.” (P. Girard, personal communication, December 3, 2021).

Forrester also agrees that social media companies like Facebook “have responsibility” of preventing climate disinformation from spreading. But Forrester also mentions that “it is unclear to me how much they are doing to curve that”, pointing out that the commitment of social media companies to combating climate disinformation often fails short: “They have policies in place that says they're going to but it's unclear how all those are enacted.” (N. Forrester, personal communication, June 24, 2021). Forrester believes that social media companies have greater responsibilities in taking a more proactive approach in policing content published on their platforms: “So I think that [tech] companies need to step up to say we're not just going to flag stuff but we’re actively going to stop spreading that information on our platform.” (N. Forrester, personal communication, June 24, 2021).

In fact, understanding the role social media platforms play in enabling the spread of climate disinformation might motivate Climate Feedback to build partnership with platforms such as Facebook and TikTok as intervention to climate disinformation. Although Climate

Feedback stresses independence and neutrality from Facebook's content decision-making process, partnering with Facebook provide the organization with some forms of access to what they considered to be the key to address the climate disinformation problem: social media platforms. The recognition of platforms being a major player in enabling climate disinformation and the efforts to build partnerships with platform to address climate disinformation reveals the multifaceted complexity of digital infrastructures: it both facilitates and constrains the construction of public perceptions of the climate crisis in different circumstances (Pearce et al., 2016).

The partnership between Climate Feedback and Facebook also raises questions about scientific autonomy and public accountability of scientists. Since Facebook publicly announced the establishment of its partnerships with third party fact-checking organizations in the aftermath of 2016 U.S. Presidential Election, these fact-checking partnerships have evolved into a what Ananny (2018) terms as the "fact-checking infrastructure" that encodes cultural assumptions, strategic goals, and evaluation standards. Indeed, using Meta-owned platform engagement tools like *CrowdTangle* to select and evaluate fact-checking claims might compromise independent and scientific judgments. Platform metrics of virality and visibility could also potentially at odds with the requirements of validity and rigorousness of scientific research and the institutional goal of public accountability (Cotter et al., 2022). Perhaps the more concerning issue is that these technological tools and institutional arrangements are subject to the transitory decisions convenient for the Big Tech. Since August 2024, Meta has suspended the service of *CrowdTangle*[59]. In January 2025, Meta announced the ending of the third-party fact-checking

[59] Meta. (n.d.). *CrowdTangle.* Transparency Center. https://transparency.meta.com/researchtools/other-datasets/crowdtangle

program. These decisions reveal the unbalanced power relationships between platforms and fact-checking partners in these disinformation interventions.

The mediation opportunity structure not only shifts understanding of scientist-led nonprofits in communicating climate science; it also shapes how media company AllSides designs its media products and implements communicative strategies. From managing social media presence, creating the media bias rating chart, to developing its own mobile app, AllSides consciously leverage knowledge of platform engagement metrics and ranking algorithms to drive communicative priorities and media tactics to maximize visibility and impact. Based on my observation of its website, AllSides's team comprises multiple tech-related professionals such as chief technology officer, data journalist, AI advisor, technical lead, product manager, and social media editor, etc. The concentration of tech professionals reveals AllSides's commitment to adapting organizational structure for coordinating communicative actions shaped by digital technology.

In addition to reinforcing the mediation opportunity structure to shape communicative strategies of social actors, interactions with digital technology also shifts social norms of public knowledge production and elevates cultural status of the tech industry. For instance, as the centerpiece of AllSides's practice, the algorithmic media bias rating system epitomizes the Silicon Valley dominant logics of data extraction and algorithmic classification in transforming public knowledge into modifiable and profitable data-based commodities. Appropriating user data as private assets and profiting from data extraction through ownership claims has been a common pattern in digital production (Sadowski, 2019). This research has shown that AllSides's algorithmic media bias ratings, through blind bias surveys, along with its mobile app are attempts to extract, claim ownership of, and profit from user data. As Burrell and Fourcade (2021) point

out, ownership over digital production facilitates social disparity tied to **“**the ascendancy of the tech industry and the reorganization of social processes through algorithms” (Burrell & Fourcade, 2021, p. 215).

The ascendence of tech industry fosters “coding elites” of Silicon Valley, including tech CEOs, software engineers, and capital investors, who have control over computational techniques to deploy data and software. Mastery of these essential techniques of digital production, therefore, grants cultural, political, and economic power to coding elites of Silicon Valley (Burrell & Fourcade, 2021). Controlling data resources and means of digital production allows Silicon Valley coding elites, from established platform giant Facebook to growing media company AllSides to accumulate economic and cultural capital to project their imaginations of social and political arrangements into products like media bias ratings and Facebook algorithms that could have profound implications for societies.

Through projecting social and political imaginations into tech products, Silicon Valley coding elites also transform the social organizational process through claims of tech neutrality and algorithmic objectivity. AllSides’s algorithmic categorization of media bias renders a hierarchy of social preferences which places “Center” ratings at the top. In incidences of news organizations reaching out and negotiating about their ratings, AllSides consolidates power in legitimizing their control of the data and a system that generates power hierarches and value judgments shaping the professional institutional practices. The “once protected proper domain of professional judgement” in most professions including journalism are increasingly superseded by tech industry logics and claims as these coding elites expands market control (Burrell & Fourcade, 2021, p. 218).

The tech industry claims of tech neutrality and algorithmic objectivity are, however, often take unobtrusive forms in the tech industry's trajectory of seizing power and control. Examining AllSides's public narratives about the algorithmic media bias rating system over the past few years has revealed contradictions: at times touting the algorithm, and at other times downplaying the algorithm. When AllSides was initially launched in 2012, analysis of its press releases shows how AllSides's founders considered as its appeal: the "sophisticated bias-detection engine" of computer algorithm (Cision PR Newswire, 2012; Evangelista, 2012). In these PR documents, the co-founder John Gable also highlighted his ambition for the future of AllSides: to be integrated into "part of the algorithms that Google or Bing uses" (Kantrowitz, 2012).

However, just four years later, in a self-published HuffPost contributor opinion piece, Gable (2016) referred to AllSides's media bias rating as "using our technology to identify different perspectives on the same topics and news stories". The vague term of "technology" has replaced "algorithm". Five years later, in 2021, in email correspondence responding to my questions about the mechanism of the media bias rating algorithm, Gable referred to AllSides's official website about rating methodologies for further information, which does not contain any information about the algorithm. Gable's answer about the design and origin of the algorithm was also evasive: "I wrote the original patent (I'm also co-founder of AllSides) though it has evolved and expanded over the years with experience and improvements from the entire team." (J. Gable, personal communication, June 7, 2021).

In 2023, the word "algorithm" is nowhere to be found on the AllSides website. When referring to media bias rating methodologies, "multipartisan analysis" has become the key word. The shift in narratives about algorithm throughout the past decade likely reflects AllSides's evolving interpretations of social climate about the role digital technology plays in social life.

When AllSides initially introduced its media bias ratings in early 2010s, critical examination of how algorithms are shaping various aspects of social life just began to gain social awareness (Pariser, 2011; Steiner, 2013), but critical studies of algorithm were still not a widely recognized topic in public discussion. AllSides's narratives about the innovative and advanced algorithm in the early 2010s could be seen as a Silicon Valley-style marketing strategy to establish itself as a legitimate knowledge producer in the public discourse.

More recently, the rise of critical algorithm studies among scholars and increased attention to the power of algorithms by journalists, activists and policy makers have prompted more widespread critical public scrutiny (Bilić, 2016; Bucher, 2018; Gillespie, 2014; Kitchin, 2017). AllSides's discursive ambivalence about algorithm likely reflects its changing interpretations of how the public perceives algorithm. The shift also reveals how Silicon Valley coding elites such as founders of AllSides leverage cultural imaginaries associated with technological artifacts and adapt discursive strategies to consolidate power and control over social knowledge production.

As one of the most powerful Silicon Valley tech giants, Facebook rises to reign on foundations of extracting, monopolizing, and profiting from data through algorithmic selection, classification, and prediction (Burrell & Fourcade, 2021; Gillespie, 2018). However, as algorithmic apparatus transforms social knowledge production and collective decision-making process, public debates increasingly focus on what rights and responsibilities digital platforms have in governing user generated data and activities (Gillespie, 2018; Gorwa, 2019). Since the 2010s, public expectations have shifted towards more regulation of online content (Flew, 2021). In 2016, the U.S. Presidential Election and the Brexit referendum further fueled public sentiment towards regulating social media platforms as they served as hotbeds for disinformation,

propaganda, and political manipulation that undermine the democratic political governance (Benkler et al., 2018).

As the de facto infrastructure for public communication, Facebook faces growing public scrutiny over its responsibility of regulating harmful content. Facebook's public facing narratives about approaches taken to address climate disinformation reflect the ongoing and intensified public pressure. But analysis of discursive justifications of these approaches, including expanding the Climate Science Center and building partnership with third-party fact checking organizations, shows only Facebook's attempts to maintain what Flew (2021) calls "self-regulatory governance framework", rather than genuine efforts of addressing its accountability concerns. Facebook's discursive strategies of associating algorithms and AI in self-regulatory approaches of addressing climate disinformation with innovation, efficiency, and neutrality demonstrate the platform's priority of maintaining its self-regulatory governance structure and associated profit model. The fact that Climate Feedback, one of Facebook's official fact-checking partners claims that they are not involved in Facebook's content decision making further confirms Facebook's full control of its self-regulatory governance without effective third-party oversight.

Indeed, findings from this research lends additional support to previous research about platforms acting as political actors making decisions with significant social impact while engineering the global infrastructure for public information and social connection (Gillespie, 2018). Analysis of Facebook's discursive construction of self-regulatory measures further supports previous arguments about how discursive construction of "appearance of accountability" provide performative covers for Facebook to continue exerting governing power (Flew, 2021). These discursive efforts, however, have minimal impact on Facebook's

fundamentally problematic business model that amplifies social divisiveness and disinformation through data extraction and surveillance (Zuboff, 2015).

Conclusion

Adopting the mediation framework (Lievrouw, 2014), this chapter examines three dynamic processes in which social actors building practices addressing climate disinformation leverage digital technology in their practices: reconfiguration of technical artifacts, remediation of practices, and reformation of social arrangements. Through identifying technical artifacts and examining the process of reconfiguration, this chapter examines three main ways digital technology reconfigures the sociotechnical contexts in which these tech-driven practices operate in: creating material conditions, economic premises, and social justifications.

First, I argue that decentralized networking technologies provide technological tools for Climate Feedback, Climate Central, and AllSides to participate in shaping the process of climate knowledge production and dissemination. Social media platforms, data analytical tools, and collaborative software, and algorithms are essential for these organizations to produce, tailor, and distribute information flow. At the same time, networking technologies also reshape public understanding of social knowledge production by expanding boundaries of news making and normalizing the involvement of social media in news making process. This shift in news making process makes it possible for these non-journalistic actors to become publicly acceptable newsmakers.

Second, I argue that digital technology provides economic premise for Silicon Valley actors like AllSides and Facebook to build up revenue streams and market control through reconfiguring the organizing structure of social information production. Digital technology enables datafication to become the central logic for data extraction, analysis, and surveillance

(van Dijck, 2014). Tracking, collecting, and analyzing data are operational logics underpinning practices of social media giant Facebook and Silicon Valley media company AllSides, which provides data resources and technical proficiency for these actors to generate revenues and extending cultural influence through owning and processing individual data for profit.

Third, I argue that digital technology provides social justifications for technical neutrality and algorithmic objectivity to be elevated as privileged logics of knowledge ordering, allowing Silicon Valley actors like Facebook and AllSides to justify their roles as neutral, disinterested third party platform and knowledge purveyors. Algorithmic classification and prediction are also privileged as legitimate forms of social knowledge production, make it possible for AllSides's algorithmic media bias rating system and Facebook's content moderation algorithms justify their power in shaping public knowledge and representing social reality.

This chapter also examines the remediation process of which interactions with technological artifacts shape communicative actions of social actors. Building on critical platform studies and infrastructure studies, I focus on two aspects, the infrastructural components such as labor, industry logics, and cultural practices, and the material properties of technological tools influence the communicative choices and priorities in these practices. I suggest that social media platforms, with its ubiquity, scalability, and indispensability are serving as critical communication infrastructures for both scientist-led nonprofits Climate Feedback and Climate Central and Silicon Valley media company AllSides. These social actors all recognize the necessity of grappling with the "platformized" communication infrastructures and "infrastructuralized platforms" in their practices (Plantin et al., 2018).

Meanwhile, I suggest that these actors also adjust their media strategies through leveraging the material properties of social media platforms such as virality, visibility,

shareability, and multi-platform applicability to reach communicative goals. For AllSides, the algorithm-driven media bias rating system also serves as infrastructure for all its services and products. As an infrastructure, AllSides's algorithmic media bias rating system also raises questions about human labor exploitation, and cultural assumptions associated with algorithmic classification in disguise of technical neutrality. Like AllSides, Facebook's efforts of addressing climate disinformation also heavily feature the narratives of tech neutrality around its uses of technical tools of algorithms and artificial intelligence. I argue that the discursive prioritization of tech neutrality and abstraction of automation help Facebook justify its invisible yet powerful infrastructure that projects governing power over social behaviors and relationships through the visibility contest while obscuring the material conditions of decision making and exploitation of human labor.

The third process examined in this chapter is the reformation of social arrangements. I focus on new patterns of social relationships, institutional norms, and organizational dynamics emerging when these social actors interact with technology in these practices. I found that Climate Central, Climate Feedback, and AllSides all recognize the mediation opportunity structure facilitated by social media platforms and leverage their knowledge of it to adapt communicative strategies. I also found that new patterns of arrangements between science nonprofits and digital platforms are emerging as these organizations build collaborations and partnerships to address climate disinformation. Additionally, I suggest that new power dynamics are emerging as ascending Silicon Valley elites control data resources and means of digital production, which allows them to project their cultural values and ideologies to shape the design of technical systems and media products, hence transform social knowledge production and collective decision making.

For Climate Feedback, Climate Central, AllSides, and Facebook, engagements with technology might take different forms, but digital technology serves as a shared boundary object that each group can use and interpret differently while maintaining interaction, connection, and collaboration across various professional worlds. Collectively, digital technology is an essential part in shaping how these social actors understand to be the cause of climate disinformation, how they envision solutions to address the problem, and what priorities and assumptions are embedded in these solutions. Meanwhile, the interpretive flexibility of digital technology also allows individualized interpretations and customized usages for social actors to adapt to their specific communicative needs.

By examining three dynamic processes in which Climate Central, Climate Feedback, AllSides, and Facebook leverage digital technology, this research highlights the nature of digital technology as not neutral and fixed objects but constant sites of negotiation of evolving norms, values, and power dynamics. The dynamic processes in which these actors leverage technology to navigate boundary negotiations, assert legitimacy, and influence public discourse also indicate that intervention to climate disinformation require constant negotiation and adaptation, accounting for the mutual shaping processes in which technologies and social practices co-evolve.

Specifically, these mutual shaping processes in which technological infrastructures shape practices and social actors adapt practices through leveraging material properties of technology fits into the discussion of combining theoretical frameworks of platform studies and infrastructure studies (Plantin et al., 2018), By highlighting the shifting digital information ecosystem that both enables climate disinformation and shapes potential solutions to address it, this research also illuminates new challenges of addressing climate disinformation that dovetail

into critical studies on algorithmic biases in structing social and political life (Gillespie, 2014; Benjamin, 2019; Noble, 2018); while also contributes to research on the intersection of media ecosystems and climate communication (Russell, 2023).

Whether it is scientist-led nonprofits, or Silicon Valley companies, digital technology provides never-before opportunities for these traditional outsiders of public information production and distribution, allowing them to effectively shape the landscape of climate communication and influence social decision making in dealing with systemic challenges of the climate crisis. At the same time, another question emerges: when social boundaries of public knowledge production are challenged, shifted, and blurred by increasing participation of traditional outsiders, what happens to professional journalists, the traditional insiders?

Chapter 4. Reimagining Journalism

In June 2024, HEATED, a popular Substack newsletter focusing on independent climate journalism analyzed 133 breaking news stories from international, national, and reginal news outlets about climate fueled extreme weathers of floods and heatwaves across the United States. The analysis revealed that only 44 percent of these news coverage mentioned climate change. Even fewer articles, 11 percent mentioned fossil fuels (Atkin & Samuelson, 2024). The result is just one of numerous examples pointing to the status quo of climate journalism: despite increasing intensity and frequency of climate events, mainstream media coverage still largely fails to directly address the climate crisis by informing the public about the causes, urgency, and consequences of it. As the "narrator, interpreter, and interloper" of the society, journalists act as a defensible force in informing, engaging, and mobilizing the public, especially during times of crisis (Callison, 2021; Hackett et al., 2017). Yet professional journalism, like the HEATED report reveals, often falls short responding to complex systemic challenges brought by climate change.

Increasing research suggests that the climate crisis is more than just environmental degradation, but a matter of intersections among political and communicative forces (Hackett, 2017; Russell, 2023). As previous chapters have shown, systematic changes in communication infrastructure and public perceptions of who has legitimacy as knowledge producers create new epistemic contexts for professional journalism. For decades, professional journalism has struggled with declining business models, market failures, declining public faith in institutions, and competitions for visibility and attention in an online information environment. As Chadwick (2017) argues, the hybrid media system blends older traditional media logics with newer digital media logics, blurring boundaries among news producers and consumers. The dynamic interactions of media logics allow non-elite actors to amplify or disrupt news narratives for their

communicative goals. Traditional outsiders of news making process such as NGOs and activist groups are increasingly engaged in news making practices in the traditional journalistic space, reshaping the landscape of public communication (Powers, 2018; Russell, 2016).

In climate communication, nonprofit organizations and journalists often jointly produce interpretations of key climate events such as the COPs, blurring professional boundaries among various actor groups (Lück et al., 2016). In programs such as Climate Matters and Partnership Journalism, scientist-led nonprofit Climate Central collaborate with journalists and TV meteorologists to co-produce news stories about local climate impact across the United States, from flooding risks of California's school districts to impact of extreme heat on North Carolina's underserved communities (Atwater & Newsome, 2024; Romero & Worth, 2024).

Climate Central exemplifies the growing interactions among professional journalists and emerging social actors that shift the boundaries among traditional insiders and outsiders of the journalistic space. New forms of knowledge production and new relationships arise between these emerging actors and journalists as they continuously interact with one another in the hybrid media system. For instance, research reveals considerable differences in tones, sources of quotes, emphasis of multimedia and visual contents between digital native media such as Vice and BuzzFeed and legacy news media in covering COP 21(Painter et al., 2018). In fact, emerging forms of "niche" climate journalism dedicated exclusively to climate news are on the rise (Russell et al., 2023). These sites bring in networks of heterogeneous social actors to collectively produce and disseminate climate information. These collaborative relationships shape the dynamics of climate knowledge production, blurring boundaries among science, journalism, and advocacy.

The weakened professional boundaries of journalism due to technological transformations and cultural shifts also makes it more challenging for journalists to claim authority and exclusivity over news production and dissemination in competitions with other social actors. When nonjournalistic actors interact with journalists in the expanding sphere of news production, they do not always share the collective goal with journalists. As Chadwick (2017) indicates, the convergence of media logics can also lead to "dysfunctional hybridity", in which the hybrid media system hosts disruptive media practices and technologies, such as disinformation, bots, and trolling, eroding democratic norms and destabilizing political engagement. Climate journalists particularly face organized climate disinformation campaigns funded by fossil fuel interests. Capitalizing on the information infrastructure that privileges profits over public interest, these fossil-fuel funded actors spread climate denialism and disinformation, sow doubt in climate science, and undermine public trust in journalism (Cook, 2019; Lewandowsky, 2021).

Social actors with distinct professional cultures, ideologies and values contribute to the "epistemological fracture" of the networked information environment, creating contentions over journalistic conventions of defining news facts (Waisbord & Russell, 2020). Tension arises between journalistic struggles to claim authority and new actors' increasing efforts to participate in the news making process (Lewis, 2012). Negotiation over the tension is also contestations over boundaries of journalism: how to define what should be included and excluded in journalistic practices, what authority and expertise journalists have, and what journalistic norms, values, principles are considered legitimate. But contestations over journalistic boundaries are not merely due to challenges from technologically enabled actors. Unlike specialized professions such as law and medicine, journalism lacks the "boundary-making mechanism" such as technical

education, licensing, and formal accreditation that help practitioners establish legitimacy (Carlson, 2017). In early stages of professionalization, the legitimacy of journalists as the public knowledge producer has always been challenged by non-journalist actors such as the PR and advertising industry (Abbott, 1988). In the 1920s, to defend the newly discovered independence from partisan media, journalists were driven to disaffiliate themselves from propaganda and publicity specialists through seeking for professional norms such as objectivity (Schudson, 2001).

Journalistic norms such as objectivity serve as boundary markers for professional journalists to distinguish themselves from nonjournalist actors. The objectivity norm especially strengthens journalistic authority in making truth claims in constant professional jurisdictional struggles (Anderson & Schudson, 2019). But the objectivity norm has long been criticized for perpetuating the representational harms that marginalize minority communities of race, gender, and socioeconomic status (Callison & Young, 2019). The current state of climate journalism particularly does not adequately address challenges climate change poses on our collective problem-solving societal mechanism (Dryzek, et al., 2011). Climate journalism at large is still shaped by institutional imperatives and power dynamics perpetuating structural oppression of marginalized social groups, privileging private profits over public interests (Boykoff, 2011; Callison & Young, 2019; Fenton et al., 2020; Russell, 2023). Rather than incorporating climate justice in storytelling, many newsrooms still identify climate reporting as only a topic, an environmental subdivision, a specialty area (European Broadcasting Union, 2023).

Responding to the challenges of climate change then requires professional journalism to shift its identity from being a boundary-confining social institution towards attending to social and political issues with public interest orientations (Kunelius, 2019). Indeed, amid epistemic

challenges of fractured social consensus on what constitutes truth and who qualifies as legitimate knowledge producers, climate journalism cannot simply ignore the "moral, epistemic, and existential" problems that shape how we understand ourselves and our relationship to the world (Callison, 2014; Hulme, 2009). These problems require journalism to move beyond institutional boundaries and incorporate a diverse set of social practices that innovate new forms of producing and distributing public knowledge. Examining these emerging practices responds to the challenges imposed on climate journalism presented by epistemological fractures of the networked information environment. More importantly, studying interactions of these emerging actors with journalists can also provide opportunities to reconsider the social functions of journalism and rearrange its priorities and resources in serving social needs in critical times.

In this dissertation, I look at three groups of social actors increasingly involved in interactions with journalists in shaping public discourse about climate change, including scientist-led nonprofit actors Climate Central and Climate Feedback, entrepreneur-founded media company AllSides and digital platform Facebook. For actors vying for shaping public discourse about climate change, the contests of establishing legitimacy and efforts of leveraging technology are essentially negotiations about the role, identity, and professional boundaries of journalism. These emerging actors bring in new dynamics into the news making process, forging new patterns of journalistic practices, reconstructing power relationships among actor groups, and redefine what is included and excluded in journalistic work.

This dissertation focuses on the evolving process of news making, contributing to our understanding of the expanding journalistic field. Building on findings from previous chapters, this chapter explores three major questions: first, what new practices, norms, values are introduced in climate reporting when emerging social actors enter the journalistic space? Second,

what motivations, values, and beliefs of emerging social actors are consistent with or in conflict with traditional journalistic practices? Third, what insights do emerging practices from outsider actors in the journalistic sphere offer for reimagining journalistic principles, mission, and commitment? To answer these questions, I draw from theoretical lenses of hybridity (Chadwick, 2017; Hallin et al., 2023) and networked journalism (Russell, 2016), highlighting the networked transformation of communication infrastructure, the blurred professional boundaries from transition of new production from professional journalism to emerging actors and practices, and the heterogeneous mutual interactions among these actors, norms, and practices.

Practices

Research has well documented the crisis of professional journalism in many democratic societies: the failing advertising-reliant revenue models (Siles & Boczkowski, 2012), the digital disruption of news production (Anderson, 2013), and the declining public trust in journalists and mainstream news organizations (Fink, 2019). As news organizations face increasing pressure from decreasing revenue sources, fierce market competition, and growing demand for public engagement (Pickard, 2017), the mingled news production between professional journalists, NGOs, citizens, entrepreneurs, and activists have generated new forms of news production (Russell, 2016). One of prominent emerging new forms of journalistic practices is the transition from exclusivity-based competitions among journalists and media outlets to collaborations among them (Bruns, 2005). These collaborations are often cooperatives and partnerships built by journalists from rivalry media outlets (Graves & Konieczna, 2015; Jenkins & Graves, 2022); multiple newsrooms resource sharing and collaboration dedicated to investigative reporting (Carson & Farhall, 2018; Konow-Lund, 2019); and institutional alliances and collaboration of fact-checkers (Brookes & Waller, 2022).

However, emerging journalistic collaborations are taken place not just among professional journalists and news outlets, but also with nonprofit news organizations (Konieczna, 2020), open-source agencies (Müller & Wiik, 2023), data analytic firms (Belair-Gagnon & Holton, 2018) and digital platforms (Ananny, 2018; Belair-Gagnon, et al., 2023). For nonjournalistic actors, collaboration with professional news organizations provide them with potential opportunities for a wider audience and sustaining their operations (Edmonds & Mitchell, 2014). For journalists, these collaborations allow them to share knowledge, incorporate large datasets and multimedia materials in their reporting, and expand the scope and depth of their coverage (Jenkins & Graves, 2019).

Particularly in climate journalism, collaborations are thriving in the hybrid news space among journalists, activists, scientists, and tech actors (Russell et al, 2023; Russell & Tegelberg, 2020). This is in part due to the unique nature and challenges of climate change reporting, which requires expertise from multiple professional fields. Journalists might not be equipped with the knowledge and training of explaining complex scientific data and evidence. Climate scientists and activists might not have the same level of understanding and reach of the targeted community audiences. Scientists and journalists might not be proficient in data analysis and presentation strategies. Connective technological tools and networks make it possible for these actors to engage in collaborative news making, sharing resources and exchange expertise. In these collaborations, boundaries among climate scientists, journalists, and other actors are blurred, making them co-producers of climate knowledge (Lück et al., 2016).

For scientist-led nonprofits Climate Feedback and Climate Central, these collaborations can take different forms. For instance, the working relationship between Climate Feedback and news organizations takes more of a loosely cooperative form. Climate Feedback does not directly

get involved in the news making process. Instead, scientist editors at Climate Feedback interact with journalists and media outlets through providing reviews and responding to subsequent feedback. In fact, Climate Feedback does not consider this working relationship as collaboration with media outlets. Rather, in the interview, Forrester indicates that the organization considers itself as a third-party "watchdog" who "has the capability to evaluate from a critical scientific perspective" (N. Forrester, personal communication, June 24, 2021). Climate Feedback's "watchdog" role for media outlets, however, can also be seen as a cooperative relationship since they share the common goal with journalists in promoting accountability and strengthening accuracy in climate reporting.

Meanwhile, Climate Central has turned collaborations with local newsrooms into institutional arrangements. In two key programs Partnership Journalism and Climate Matters, Climate Central builds collaborations with local journalists and local TV meteorologists and provide scientific and technological support to these local media outlets. The reporting resources provided by Climate Central are much needed for local newsroom as they continue to struggle with declining advertising revenue, staffing shortage, and pressure of covering a broad range of topics. In both programs, local TV meteorologists and news reporters receive visuals, maps, graphs, and data analytics from Climate Central to back up their weather forecast and stories with scientific data and evidence to illustrate local impact of climate change. The institutionalized collaboration ensures the regularity and sustainability of research and funding support, staff coordination, and organizational accountability from Climate Central, as the organization is structured around these major programs (P. Girard, personal communication, December 3, 2021).

The collaboration between Climate Central and local newsroom in the Journalism Partnership program reveals patterns of co-production that blur the professional boundaries between scientists-led nonprofits and news media outlets (Lück et al., 2016). Unlike journalists, science communication nonprofits like Climate Feedback and Climate Central not burdened with profit pressure and limited resources to compete in the media market. In building partnerships with journalists, they share the mission of producing and distributing accurate scientific information to the public and facilitating robust public discourse about the climate crisis. The shared goal obscures the traditional division of labor and roles is in these collaboration programs. Besides supplying science-backed data and visualizing tools to be incorporated in the reporting, Climate Central also performs roles of professional editors by providing topic recommendations and editorial support to partner journalists.

The highly coordinated production process underscores a "symbiotic relation" (Russell et al., 2023): with in-depth and accurate scientistic support and reader-friendly data visuals, journalists communicate more effectively to the local community, as they are the "expert on what the local experience in the local audience goes through" and "know and care about the story on the audience" (P. Girard, personal communication, December 3, 2021). Climate Central's approach of "reporting, editing and guidance"[60] in collaborating with local news organizations is distinct from conventional forms of journalistic collaborations with nonprofits, where collaborating organizations are usually treated as sources and not directly involved in the reporting and editing process. The connectivity in these new forms of interactions between scientists and journalists highlights overlapping roles, norms, and tools in practices, indicating

[60] Climate Central. (n.d.). *Partnership Journalism.* Climate Central. https://www.climatecentral.org/partnership-journalism

blurring professional boundaries of formerly separated domains of science, journalism, and technology (Brüggemann et al., 2020).

The crisis of journalism does not just prompt journalists to seek collaborations to revitalize their professional practices; it also contributes to the rise of fact-checking practices as a movement reforming the professional journalistic practices (Amazeen, 2020). Modern fact-checking practices, stemming from muckraking journalism, can largely be seen as efforts of professional news organizations adapting to the advent of networking media system, reviving and defending the professional norm of objectivity (Graves, 2016). For example, FactCheck.org, one of the earliest dedicated fact-checking organization in the U.S., was staffed by professional journalists (Graves, 2018). From sharing the collective goals of informing the public and improving journalism (Amazeen, 2020) to reorienting journalistic practices to emerging form of collaboration (Graves & Konieczna, 2015), the fact-checking movement in the U.S. has been closely tied to the professional journalistic community.

As the fact-checking movement grows and spreads globally, non-journalists are also entering the fact-checking field, where "boundaries" are not being drawn by professional journalists (Graves, 2018). The practices of Climate Feedback and Climate Central can be seen as fact-checking endeavors from scientist-led nonprofits. Both organizations share the broader epistemological commitment of the movement: assessing the veracity of public claims and content based on principles of fairness and nonpartisanship (Mena, 2019). Both organizations meticulously emphasize their commitment to nonpartisanship and neutrality. Climate Feedback is accredited by the International Fact-Checking Network (IFCN), the global network of professional fact-checks (Climate Feedback, 2018). However, the fact-checking approaches of Climate Feedback and Climate Central are also distinct from professional fact-checking. Climate

Feedback has characterized their approach as "paving the way for a new kind of fact-checking"[61]. Compared with the "journalistic core" of most prevalent fact-checkers, the fact-checking practices of Climate Feedback and Climate Central demonstrate some notable differences in their focus, motivation, mission, and institutional logics.

First, the "new kind of fact-checking", as Climate Feedback proposes, combines both in-depth article reviews and shorter claim reviews. But the focus is on the longer, in-depth article reviews with detailed annotations and references. Climate Central's collaboration with TV meteorologists and local journalists also produces in-depth contextualized stories about climate impact. The in-depth, explanatory, and longer form of fact-checking sets their practices apart from conventional quick hit fact-checking practices. Second, unlike professional journalistic fact-checkers who assesses a range of political claims and content, the motivation of both organizations is issue-driven, concerns about the climate crisis and its public impact are the driven force behind their practices. Third, unlike journalistic fact-checkers drawing clear boundaries from partisan "watchdog" groups and defending their ties to news organizations and promoting public trust in journalism (Graves, 2016), Climate Feedback and Climate Central only view journalism as an outlet to promote climate science. Rather than reforming journalistic practices to reaffirm professional ideals like professional fact-checkers, the ultimate mission for both organizations are "pedagogical" (Climate Feedback)[62] and "scientific" (Climate Central)[63]. Last, while professional fact-checkers in the U.S. seek for source validation and research insights from nonprofit and academic actors (Graves, 2018), the practices of Climate Feedback and Climate Central take an institutional approach. Instead of merely being an outside source for

[61] Science Feedback. (n.d.). *About.* Science Feedback. https://sciencefeedback.co/about/
[62] Ibid.
[63] Climate Central. (n.d.). *Our approach.* Climate Central. https://www.climatecentral.org/our-approach

references, Climate Feedback's community crowdsourced in-depth reviews and Climate Central's climate science communication projects both integrate the fact-checking goal of bolstering veracity of climate stories into institutional arrangements.

Scientist-led nonprofits like Climate Feedback and Climate Central are not the only actors entering the expanding field of fact-checking. To curb the spread of disinformation, Facebook has also incorporated content moderation mechanisms of editorial review, community flagging, and automatic detection (Gillespie, 2018). But Facebook's content moderation mechanisms are fundamentally different from professional fact-checking. Professional fact-checking aims at strengthening the accuracy of reporting, reforming journalistic norms, and defending legitimacy of journalism (Graves, 2016). In contrast, Facebook's self-regulatory measures of flagging, labeling, and removing online user contents are interventions of information circulation, political expression, and culture through systems designed to reward or punish (Gillespie, 2022). Facebook frequently cites principles of "free expression" and "vibrant community" as discursive justifications for its decisions of elevating or reducing certain content (Gillespie, 2018). But in fact, Facebook's content moderation mechanism only "presumes and reifies the logic of the system it is designed to correct" (Gillespie, 2022, p. 9).

Besides using automated systems to detect and flag problematic content, Facebook also recognizes the necessity of including "human oversight and adjudication in their content moderation practices" (Gillespie, 2018, p. 107). For Facebook, a frequently cited key strategy to combat climate disinformation is building partnerships with third-party fact-checking organization certified through the International Fact-Checking Network (IFCN) (Meta, 2022d). Facebook's partnership with professional fact-checkers, according to Ananny (2018), represents

a new form of "platform-publisher collaboration", creating a communicative infrastructure shaped by partners' tools and practices.

However, whether these emerging partnerships have any real impact on effective intervention to climate disinformation is questionable. Research has suggested that Facebook's method of labeling false information and adding fact-checking labels results in compromised effects of "asymmetric adjustment" due to partisan divide (Jennings & Stroud, 2021). These fact-checking partnerships also seem to have limited impact on Facebook's content moderation decisions. As one of its fact-checking partners Climate Feedback points out, after a claim is vetted by fact-checkers, it is Facebook who "choose what to do and how to move forward from there" (N. Forrester, personal communication, June 24, 2021). Indeed, in a public statement explaining the fact-checking process, Facebook confirms that fact-checking partners do not have the right to remove content from its platforms. It is up to the company to make such content decisions based on its "Community Standards" (Meta, 2021b).

In fact, the philosophy behind platform self-regulation approach is "technological solutionism", the belief that disinformation can be solved by optimizing algorithms and clearly defined technical solutions (Schulte, 2020). But the technological solutionism approaches taken by Facebook to address climate disinformation, including fact-checking partnership and content moderation mechanism are all "downstream" solutions that fail to address the real issue of extracting human experience for surveillance capitalism (Zuboff, 2021). As Zuboff (2021) argues, platform content moderation mechanism can only be "a last resort" since these efforts, regardless of how Facebook frames them, cannot compare to its profit-driven algorithm amplifying disinformation and distrust.

Indeed, one of the major challenges professional journalism faces is associated with the rise of algorithms and big data practices in news making process. The adoption of digital tools and computational techniques in news production is transforming journalistic practices, attracting growing research interest in new forms of journalism, such as data journalism (Appelgren, 2018; Hermida & Young, 2019a), automated journalism (Carlson, 2015b), and computational journalism (Diakopoulos, 2017). The social media data analytic tools by Climate Feedback, the data-generated visualization tools by Climate Central, the algorithmically aggregated media bias rating system by AllSides, and the algorithm and AI driven content moderation mechanism by Facebook, are all examples of emerging data-driven trend of news production.

As social media data analytics, algorithms, and AI increasingly weave into the information infrastructure, they provide new opportunities for innovating journalistic practices. Social media data analytics, as Forrester of Climate Feedback puts it, can be "a really good way to track misinformation claims" and gauge the virality of those claims (N. Forrester, personal communication, June 24, 2021). Likewise, the data visualization tools used by Climate Central, such as the Sea Level Rise visual simulation and the Climate Shift Index map, according to Girard, are "impactful on social media" and "easy to understand and quick to embrace" (P. Girard, personal communication, December 3, 2021). Previous research has shown that these data-driven techniques have already been used by journalists to increase efficiency of reporting and attract viewership through analyzing audience engagement data and making stories with more accessible visualizing features (Van Dalen, 2013).

Meanwhile, data-driven practices also elevate the status of technological tools and expertise, posing challenges to the journalist-centered news making process, further contesting

journalistic authority in the networked information environment (Carlson, 2015b; Carlson, 2017). In social media age, news presented to audiences are not just a result of professional judgment of editors and journalists, but also algorithmic curated rankings and recommendations developed by tech companies based on user preferences (Fletcher & Nielsen, 2018). Algorithmic gatekeepers play an increasingly prominent role in shaping and determining the type, content, and visibility of news information to be presented and get disseminated (Bastos, 2014). More recently, the increasing adoption of generative artificial intelligence in news making has led to automation undertaking journalistic work, which further challenges the centrality of journalistic expertise in the news production (Møller, Skovsgaard, & De Vrees, 2024). The growing prominence of computational technology in news production also contributes to the "dislocation of news journalism", particularly, a displacement of power for professional journalists with ongoing shifts of revenue and influence from news organizations to social media companies (Ekström & Westlund, 2019).

The increasing cultural significance of algorithms and artificial intelligence enables Silicon Valley actors to exert power in shaping public discourse. The discursive construction of AllSides's media bias rating system and Facebook's content moderation mechanism are both efforts of contesting normative assumptions about journalistic role in news judgments. AllSides's discursive framing of its media bias targets on invalidating assumptions associated with the journalistic norm of objectivity. The discursive justification of "media bias" is built upon the premise of replacing the "view from nowhere", objectivity-centered journalistic news judgments with AllSides's version of "view from everywhere", muti-method approach of news judgement. Likewise, Facebooks' discursive framing of its content moderation technologies such as automated detection and AI models attempts to normalize privately owned digital intermediaries'

power over public discourse (Gillespie, 2022). In fact, both AllSides and Facebook legitimize and normalize techno-libertarian logics of curating public information through challenging normative assumptions about the role of journalists as gatekeepers of public information.

Tension

Interactions between journalists and emerging social actors entering the news making process facilitate new patterns of journalistic practices. These new practices reveal patterns of consistency and variation of journalistic norms, values, and perception of roles (Painter et al., 2024). Tension arises in these interactions as nonjournalistic actors bring in new dynamics into journalistic practices already imbued with persisting journalistic roles, norms, and values. For technology driven practices addressing climate disinformation, from scientist-led nonprofits to Silicon Valley tech entrepreneurs, their professional norms and priorities in practices might not always be consistent with their journalist counterparts. Examining tension between journalistic and nonjournalistic roles, norms, and values helps us understand which traditional journalistic values persist or being challenged under what circumstances, and how we can better situate professional journalism in the dimensions of "authority, power, and knowledge" of the shifting media landscape (Painter et al., 2024).

Some prominent journalistic norms persist in tech-driven emerging practices addressing climate disinformation. Objectivity, one of the most enduring professional norms in journalism is still prominent in fact-checking practices of Climate Central and Climate Feedback. As discussed in Chapter 2 Establishing Legitimacy, both organizations highlight organizational principles of scientific independence, research autonomy, and policy neutrality. Additionally, both organizations incorporate the peer review mechanism as a boundary policing criterion to claim scientific objectivity in producing public knowledge about climate change. Like routine practices

journalists rely on to maintain objectivity (Tuchman, 1972), the peer review system functions as a strategic ritual for scientists in Climate Central and Climate Feedback to defend scientific objectivity and independence from potential attacks of their legitimacy. Through elaborations of how routines, standards, and procedures of the peer review system is being maintained in their practices, Climate Feedback and Climate Central reify their commitment of producing and disseminating accurate and valid scientific knowledge.

Climate Feedback and Climate Central's rituals of affirming scientific objectivity reinforce the objectivity norm in journalism by shared commitment of accurate and reliable public truth-telling. The shared commitment partially comes from the common need of scientists and journalists as public truth tellers in democratic societies, as the authority and legitimacy as public truth tellers is dependent on defending claims of reliable and accurate public knowledge production (Carlson, 2017). However, their interpretation of journalistic objectivity is shifted from the traditional impartial and neutral ethical stance. Beyond the conventional factual verification of claims, Climate Feedback and Climate Central focus on contextualizing and interpreting climate science in news stories. From Climate Feedback's in-depth article reviews to Climate Central's visualizing tools, both organizations strive to make stories about climate science tangible and digestible to average audiences, which can help counter the influence of climate disinformation campaigns (Painter et al., 2024). Their approaches of producing and communicating contextualized and accessible scientific knowledge also demonstrate the "pluralistic" turn in objective journalism: objective in factual truth, but pluralistic in "interpretation, aspects and perspectives" (Hackett et al., 2017, p. 27). These efforts represent a new kind of journalistic objectivity: authoritative in science, and "highly specialized in the knowledge of complexity of the science" (Painter et al., 2024, p. 15).

This contextualized approach also highlights the role of journalistic expertise in translating the complex scientific sources to accessible news stories (Carlson, 2017). As shown in Chapter 2 Establishing Legitimacy, journalists are "interactional experts" in conversing fluently with both the sources and the audience (Collins & Evans, 2007; Reich, 2012). At the core of liaison between sources and audiences is professional journalistic judgment, the seemingly self-evident "gut feeling" of newsworthiness (Schultz, 2007). Journalistic judgment of newsworthiness still predominates the practices of Climate Feedback and Climate Central. Examining the employee information listed on websites of both organizations shows professional journalists serving as editors making important content decisions. Particularly, in Climate Central's Partnership Journalism program, journalistic judgment is the driving force behind each story. In the interview, Girard emphasizes that "it's important for us that the story be driven by a local outlet. We're not dictating or providing a story. It has to be led by a reporter who knows and cares about the story on the audience (P. Girard, personal communication, December 3, 2021)."

Journalistic judgments do not just play important roles in collaborations with scientist-led nonprofits like Climate Central; it is also visible in content moderation systems of digital platforms such as Facebook. Based on my observation of the Facebook Climate Science Center, often referred to by the platform as one of its most important approaches of addressing climate disinformation, the center has incorporated a featured section, "in the spotlight", which includes videos and stories about climate change "selected by a team of experienced journalists at Facebook"[64]. These media content comes from established new organizations such as *The New York Times, The Washington Post, PBS, Reuters*, etc. Through incorporating and highlighting journalist-selected content published by news organizations, Facebook capitalizes on the

[64] Climate Science Center. (n.d.). Climate Science Center. *Home [Facebook page]*. Facebook. Retrieved December 12, 2024 from https://www.facebook.com/climatescienceinfo

professional expertise of journalists to legitimize its role in shaping public discourse about climate change.

However, the fact that journalistic judgment is featured on an algorithmically driven platform is a testament to the creativity and irreplaceability of journalistic expertise in hybrid sociotechnical systems. Indeed, Facebook's strategy of employing human-centered journalistic judgments in its key mechanism of addressing climate disinformation reinforces the "relational power" of journalism (Carlson, 2017). Accepting and referencing journalistic content on Facebook Climate Science Center attests to the legitimacy of journalistic methods, norms, and roles in producing trustworthy, fact-based public knowledge about climate change.

Indeed, Facebook's climate science center exemplifies the persisting centrality of "traditional, human-centered editorial decision making" (Napoli, 2019). Despite efforts of Silicon Valley actors of bolstering the legitimacy and superiority of algorithmic systems in making public content decisions, the human factor is still irreplaceable in the decision-making process. In the case of AllSides, as a media company building its media bias ratings system challenging the premises of objective journalism, it also acknowledges some form of journalistic judgment involved in their editorial decisions. When asked about how AllSides selects issue topics to present different media perspectives, Mastrine, the Director of Marketing at AllSides states: "We have someone from our news team actually just determine like what is being talked about the most in the news landscape right now and he'll update those." (J. Mastrine, personal communication, May 14, 2021).

In fact, this single employee of AllSides is performing a job equivalent to the entire organizational process of news judgment in legacy news media, which involves hierarchical process of coordinating multiple personnel and resources and is shaped by social, cultural, and

organizational dynamics. Such an important editorial position with extensive responsibilities falls on one individual is nonetheless rarely acknowledged by AllSides. The fact that human factors are often deliberately obscure in these algorithmic systems also speaks to the irreplaceable role of journalistic judgment. Without human creativity and influence in decision making, the self-claimed "advanced and superior" algorithmic systems cease to function.

For journalists, however, the rise of algorithms in news production and the elevation of computational technologies in social and cultural life may shift how cultural capital in journalism is represented (Usher, 2017). The material rewards of resources, status, and prestige in professional development might be more determined by designing optimized algorithms in news selections and enhancing visibility metrics than experiences in investigative reporting and in-depth news analysis. The shifts in representation of cultural capital could also further contest journalistic legitimacy, as the journalistic role as producers of cultural knowledge is constructed through ongoing negotiations with other social actors (Carlson, 2017). The shifting assumptions about algorithmic judgment, particularly about algorithmic objectivity and algorithmically driven personalization raises new questions about how news knowledge is being produced and what role journalism is socially expected to perform (Carlson, 2018a).

In many ways, professional expertise of journalists, including professional news judgment is still a prominent presence in emerging tech-driven practices. Journalists' learned sensibility and belief that enables them to navigate through complex and fast-changing information and make decisions about news values is a distinct feature of journalistic authority (Carlson, 2017). However, what constitutes journalistic authority in public knowledge production is shifting. Traditionally, judgment of news values is deeply grounded in consensual cultural knowledge about social reality (Schudson, 1989). News values are, according to Gans (1979),

shaped by various social factors including institutional norms, organizational constraints, power structures of the news organizations. With the rise of social media platforms in the news production and dissemination process, the cultural consensus on news values is being reconstructed by technological norms, values, and cultural assumptions.

For Climate Feedback and Climate Central, social media platforms have become a vital communication infrastructure for effectively communicating scientific information to the public. As discussed in Chapter 3 Leveraging Technology, both organizations leverage material properties of social media platforms to help them maximize communicative goals. The incentive for Climate Feedback and Climate Central to use platform analytics to gauge audience engagement and decide content priorities reveals a shift from "organization-centered" news values to "audience-centered" news values (Bastian, et al., 2021). Audience-centered new values associated with social media platform engagement such as visibility, virality, and shareability are becoming more prominent in topic selection and editorial priorities. The shift does not render organization-centered news values obsolete, as norms such as objectivity and independence are still dominant in fact-checking practices of Climate Feedback and Climate Central. The shift, however, does elevate the audience-centered news values to communicative priorities in the matrix of professional news judgment.

The ascendance of audience-centered metrics also highlights the tension between networked expertise and institutional expertise (Hermida, 2012). The tension results from a clash between expectations of transparency and the opaque professional control (Revers, 2014). The growing cultural significance of algorithms in news production and distribution enables Silicon Valley actors to project their values such as transparency into the epistemological foundations of knowledge production. As Chapter 2 Establishing Legitimacy indicates, both AllSides and

Facebook claim transparency value in practices as a key strategy of legitimizing their role in shaping public knowledge production. The discursive prioritization of transparency value reflects the ascending Silicon Valley actors' perception of vulnerabilities of journalistic judgment in the post-truth era. These actors come to understand that transparency value can be a potential remedy for legitimizing their role in curating public information. The elevation of transparency value as a key legitimacy strategy also reveals challenges journalists face in defining and defending their ingrained professional values when interacting with other social actors (Waisbord, 2013).

Professional new organizations have also advocated the transparency value in journalistic practices to enhance credibility and accountability of journalism (Craft & Heim, 2008; Singer, 2007). Transparency has been included in the updated code of ethics for Society of Professional Journalists in 2014 but not yet fully enacted in journalistic practices (Vos & Craft, 2017). The emergence of transparency as a value reveals growing demand for more openness in public knowledge production process. For both Silicon Valley actors and journalists, transparency can serve as a potential tool for strengthening their legitimacy in shaping the public discourse. In contrast to the fraught norm of objectivity, transparency offers a better approach to deal with issues of subjectivity and human bias in journalism with an increasing skeptical public in the networked era (Phillips, 2010; Weiss, 2012). For AllSides and Facebook, justifying their work based on transparency claims makes it possible to discursively legitimize the superiority of their algorithmic systems over human-centered professional news judgment. For journalists, elevating transparency as a central journalistic value provides a desirable discursive alternative to rebuild relationship with the public and reclaim professional legitimacy when objectivity, the epistemological basis of their professionalism is under increasing critical scrutiny (Karlsson, 2010; Vos & Craft, 2017).

However, perceptions of how transparency should play out in practices vary among these emerging tech-driven actors. As discussed in Chapter 2 Establishing Legitimacy, even though elevating the transparency value is framed as an organizational priority, both AllSides and Facebook largely fail to perform what Karlsson (2010) calls "rituals of transparency", the techniques and features that embody the notion of transparency in practices. Rather, for Silicon Valley actors like AllSides and Facebook, claiming transparency is mostly paying lip service to legitimize their roles in curating public information while exploiting declining public trust in journalism. In fact, claiming commitment to transparency disguises their incentives of prioritizing profits over public interests while expanding influence and power to shape the public discourse. For example, despite discursive prioritization of transparency as a central value in their practices, including performative displays of multiple rating methods, examination of discourse of AllSides across multiple sources shows that the organization falls short to disclose how these rating methods are factored in the rating results. The company especially shuns its algorithm that aggregates and assigns rating results to media outlets from its public-facing narratives. Without information and access for tracking and monitoring the algorithm that generates rating results, AllSides's public-facing transparency claims are at best performative strategies to legitimize its role and cultural influence in shaping public discourse based on its own vision of truth-telling.

In contrast, Climate Feedback and Climate Central, without claiming transparency as a legitimizing strategy, perform some forms of transparency rituals, mostly through displaying scientific rigorousness of research and increasing audience accessibility. These transparency indicators, as identified by Karlsson & Clerwall (2018), include presenting hyperlinks to sources, in-text annotations, peer-review references, disclosing funding and ownership information, and

providing access for public feedback and oversight. For instance, a sample Climate Feedback review article published on September 27, 2024, debunked claims made by *The Daily Wire* that a light hurricane season invalidates "the climate change theory" (Science Feedback, 2024). The review highlights the claim in question, marks the verdict as "inaccurate", explains the verdict reasoning, and provides detailed scientific information peer-reviewed by climate scientists. The review also includes hyperlinks to sources, references, information of reviewers, and peer feedback among reviewers.

The different perceptions of transparency among these actors also reveal various motivations behind their practices of addressing climate disinformation. Even as professional boundaries blur in interactions among emerging social actors and journalists, they do not always share similar incentives. Although both AllSides and Facebook feature journalistic contents, judgments, and expertise in their practices, their intention is not to revitalize journalistic practices or to restore legitimacy of professional journalism. Rather, through discursive legitimization of algorithms and automated systems as more objective, advanced, and effective, both organizations to bolster their power in shaping public discourse. The belief in technological objectivity embedded in discourse of algorithmic approaches of addressing disinformation and biases also exacerbates the epistemological predicament of journalists in the post-truth era by suggesting human subjectivity is inherently flawed (Carlson, 2018b).

Besides challenges to professional journalistic judgment from algorithmic systems, the struggle between profit and public good in journalism also contributes to the predicament of journalists. The tension between competitive pressure of generating revenue and civic obligation of serving public interest has been a constant feature of the U.S. commercial media system (Pickard, 2014). The rise of Silicon Valley actors like AllSides and Facebook threatens the

traditional advertising revenue model of journalism. Journalism's reliance on advertising revenue becomes a vulnerability for outside actors to challenge its legitimacy in social and political life. For example, on its website, AllSides juxtaposes its funding model against the advertising revenue model of professional journalism to demonstrate its "social good mission" as yet another legitimization strategy:

> "AllSides' business and funding model aligns with our social good mission. It encourages our team to prioritize quality, credibility and balance that supports our brand and leads to more subscriptions and service revenue rather than instantaneous gratification and sensationalism that drive advertising dollars." (AllSides[65])

Alternatively, nonprofits like Climate Central and Climate Feedback seems to provide a more civic-oriented approach in producing public knowledge about climate change, as these foundation-supported nonprofits are not bounded by profit pressure from the media market. But as Benson (2017) suggests, foundation-funded journalism could also compromise professional autonomy of journalists by driving news agenda towards issues they deem as important, catering to a small group of elite interests. More importantly, foundation-supported journalism could also shift journalistic role perceptions and values in the news making process through shaping the organizational structures and incentives of news organizations (Scott et al., 2019). For instance, on its website, the parent organization of Climate Feedback, Science Feedback discloses that it owns a subsidiary company that conducts commercial fact-checking in partnership with platforms such as Facebook and TikTok[66]. Although the organization claims editorial independence in their practices, whether the commercial partnerships with digital platforms

[65] AllSides. (n.d.). Ownership information. AllSides. https://www.allsides.com/about/ownership
[66] Science Feedback. (n.d.). *Partners, funders & donors*. Science Feedback. https://science.feedback.org/partners-funders-donors/

influence the priorities and standards of fact-checking remains unclear. For journalists, the challenge lies in maintaining independence and autonomy in serving public interests while expanding professional boundaries to interact with other social actors.

Lessons

The opportunities and challenges brought by emerging tech-driven practices provides some insights for rethinking the social arrangements of professional journalism in addressing the "epistemological rifts" at the center of climate disinformation (Russell, 2023). As an "institutionally based cultural and political practice", journalism serve important social functions in informing public about crises and facilitating collective actions and policy changes (Hackett et al., 2017). The new patterns of practices brought by emerging tech-driven practices reveal new roles, norms, and values that shape the news production process, redefining the professional boundaries of journalism.

The emerging "co-producing" relationships between nonjournalistic actors and journalists exemplify new hybrid modes of journalistic practices, such as Climate Central's partnership with local newsrooms to produce science-backed local climate news stories. The complexity of the climate crisis and the abstract nature of climate science requires journalists to build alliances and broaden interactions with other social actors such as scientists to co-produce high quality information about climate change (Kunelius, 2019). It is evident that for journalism to adapt to the shifting conditions of climate communication, it needs to expand institutional boundaries to be more inclusive to hybrid forms of news production, increase interactions with emerging social actors, and build new relationships to leverage the power and influence of these actors (Chadwick, 2017; Kunelius, 2019; Russell, 2023).

The blurring professional boundaries in these emerging co-production practices also point to potential professional gains and losses for journalists. Collaborations with scientific nonprofits can help journalists strengthening the veracity of scientific facts and credibility of reporting. These organizations also provide scientific expertise and research resources for journalists to conduct more in-depth climate reporting, which they would not have the resources to do otherwise, as newsrooms continue to struggle with the declining business model. Partnerships with tech companies, especially those with social media platforms provide journalists with funding support and could potentially strengthen the relationship with the audience (Rashidian et al., 2018).

But potential risks of compromising journalistic autonomy and independence should also be noted in nonprofit and journalist partnerships (Benson, 2017). Funding support from either foundation supported nonprofits or technology companies could potentially shape journalistic role perception and reporting agenda through influencing organization dynamics and incentive structures (Scott et al., 2019). Partnerships with digital platforms could also render journalistic expertise susceptible for platforms to justify their role in sidestepping responsibilities in addressing climate disinformation. It is crucial for journalists to keep serving as the bridge between climate scientists and the public and enhancing scientific validity and accuracy in reporting. But at the same time, it is also important to understand power dynamics shaping the hybrid interactions between journalists and nonjournalistic actors. Journalists should continue developing effective forms of climate story telling with actors who share the epistemological goals of making “more relevant, compelling, urgent and just” climate stories in their efforts of shaping public discourse (Russell et al., 2023, p. 1402).

As Chadwick (2017) suggest, the hybrid media system not only facilitates openness and collaboration; it could also enable conflicts and manipulation. The ubiquity of social media platforms in the news making process elevates the power of emerging "complex peripheral actors" such as Facebook in shaping the production and distribution of news (Hermida & Young, 2019b). The prominence of these actors also poses an "industry logic" of prevalent social media use among journalists (Lewis & Molyneux, 2018). Social media platform engagement metrics have been built into the priorities of producing and distributing news content, driving media outlets to optimize and curate content catering to platform algorithms (Meese & Hurcombe, 2021). But the assumption of necessity of social media use in journalism, like Lewis and Molyneux (2018) suggest, overlooks issues critical for the development of journalism, including questions about the dominance of platform companies in constructing collective public discourse. In journalistic practices, incorporating user engagement metrics tools like CrowdTangle (used by Climate Feedback) could be efficient in evaluating content distribution and user traffic, but dependence on these metrics could also compromise editorial independence of journalists (DeVito, 2017; Paik, 2023), disrupt the business model of news organizations (Usher & Carlson, 2018), and raise concerns about power and accountability in public communication (Ananny, 2018).

As platform audience-centric metrics are increasingly normalized in news judgment, journalists are forced to cede some gatekeeping power to social media platforms. New professional values projected by Silicon Valley actors in the news making process pose challenges to the epistemic authority of journalists and the institutional legitimacy of journalism. The value of transparency, for one, has been elevated by tech actors to be the new professional ideal for justifying their role in shaping public discourse. Despite claims of transparency, tech

actors like AllSides and Facebook rarely enact any meaningful actions to demonstrate commitment to transparency in their practices. The strategic use of the transparency value is a rhetorical move to bolster the legitimacy of these Silicon Valley actors in the public discourse through challenging the epistemic authority of journalism, which is rooted in traditional norms of professionalism and objectivity (Carlson, 2017). In the hybrid media system, the blurred boundaries allow nonjournalistic actors to further challenge established journalistic norms and practices.

Emblematic to the challenges to journalistic legitimacy and authority in the rapidly transforming media landscape is criticism of the long-standing objectivity norm in journalism. Increasing scholarship offers critical reappraisals of how the objectivity norm in the white and male dominated profession of journalism has legitimized and perpetuated injustice and alienation in minority communities (Callison & Young, 2019; Usher, 2021). The Western-centric notion of objectivity and neutrality, as Haraway (1988) points out, is grounded in masculine power and control supporting dominant social structures and reinforcing power inequalities. Climate knowledge, like any other kind of social knowledge, is situated in social, political, and material contexts. Yet the reality is climate journalism has a historical pattern of excluding a myriad of voices and perspectives situated in non-Western contexts and dismissing life experiences of Indigenous people and people of color (Callison & Young, 2019; Russell, 2023). As Callison and Young (2019) argue, we need to reflect on who journalists have long been claiming to speak for.

One of the key challenges for journalism to reclaim legitimacy today is to reckon with the historical representational harm of misrepresentation and stereotypes in reporting (Callison & Young, 2019). On one hand, such reckonings involve “historical repair work” of revisiting historical narratives, exposing systemic inequalities and injustices, and promoting institutional

accountability (Usher & Carlson, 2022). On the other, such reckonings call for a climate justice approach, which underscores the root cause of the climate crisis as structural inequality and systemic injustice in distribution of risks, benefits, and responsibilities (Gunster, 2017). A climate justice approach in journalism requires systemic interventions to the structural exclusions and underrepresentation in climate reporting.

These interventions include diversifying sources (Myers et al., 2022; Wenzel, 2021), diversifying the newsroom by incorporating marginalized non-white and indigenous perspectives and knowledge (Callison, 2021; Roosvall & Tegelberg, 2018; Russell, 2023; Tsai et al., 2022), enhancing journalists' collaborative role in supporting climate movements and policies advocating for climate justice (Hackett et al., 2017), and strengthening commitment to distinct needs of diverse communities that journalists serve (Arguedas et al., 2023). Indeed, journalists has the power to expand the definition of legitimate sources of authority and broaden the scope of equity in public discourse (Kunelius, 2019; Russell, 2023). Historically underrepresented and marginalized communities in the news are also communities most disproportionally impacted by the climate crisis.

While fossil fuel funded disinformation campaigns continue to exploit the professional norms of fairness and objectivity of news organizations and the audience engagement metrics to strategically amplify their false messages, the climate crisis calls into question the normative assumptions of journalism (Eide & Kunelius, 2012) and urges journalists to reflect upon contested professional norms, the social construction of professional authority and expertise, and implications for disadvantaged communities. This requires rethinking the contested boundaries of authority and expertise in journalism, which has been products of racial, gendered, and colonial social hierarchies (Callison & Young, 2019). It also requires positioning journalistic

authority in the power structures and social relations (Carlson, 2017) and recognizing situated knowledge as a form of expertise (Callison & Young, 2019).

Climate Central's collaborative programs with local TV meteorologists and local newsrooms provide an example of amplifying situated expertise and knowledge, as these trusted voices of local community drive the directions of these new forms of news production. Pivoting on local expertise and local perspectives also responds to the call for centering the "place" at the center of journalism practices and scholarship (Usher, 2019). Historical legacies of denying subjectivity and locatedness has contributed to undermine the relevance and legitimacy of journalism in the publics (Callison & Young, 2019). Reorienting journalism towards local communities, like Climate Central's projects of local collaborations help supply crucial localized information and engage local deliberation over climate policies, contributing to the robustness of public engagement. These community-specific interventions also highlight the critical role that local news media play in communicating differing perspectives within communities (Bowden et al., 2021).

Effective climate communication requires robust local news media. However, research has well documented the crisis of local journalism (Nielson, 2015). On one hand, the crisis of local news media has to do with the digital transition of the information environment. The business model that local news media relies on is collapsing, as advertising revenue shifts online, readership plummets and fragments, prompting large scale of newsroom layoffs and closures (Nielson, 2015). On the other hand, the crisis of local journalism has historical roots in the expansion of media ownership concentration and domination of media conglomerates, which imposes enormous economic pressure on local newsrooms, inducing emphasis on profit over public service (McChesney & Nichols, 2011). The dominance of corporate media in the media

landscape and media policy movement pushing for media market deregulation undermines democratic processes by hindering accountability journalism (Pickard, 2014).

The profit-driven commercial media system fails to support journalism in serving the public and holding power accountable (Fenton et al., 2020). The deregulated media market lay the foundation for monopolistic control of tech oligarchies over the information infrastructure, which plays host to fossil-fuel funded climate disinformation and propaganda (Russell, 2023). To effectively communicate climate change to the public, we need high quality, independent, and locally oriented climate journalism. It requires decoupling journalism from for-profit market forces and increasing public funding invested in public interest oriented local journalism (Fenton et al., 2020; Pickard, 2019; Russell, 2023). We also need stronger public oversight and robust regulation of digital platforms. The self-regulatory measures undertaken by Facebook, as examined in this dissertation, are mostly performative PR acts in response to public pressure and far from effective in promoting healthy public discourse.

Conclusion

The three cases examined in this dissertation are all traditional "outsider" attempts to shape the public discourse about climate change. The three approaches to address climate disinformation examined in this dissertation, including climate scientist-led institutional fact-checking, Silicon Valley entrepreneur-led media literacy, and tech platform self-regulation can all be seen as circuitous pathways to understanding the shifting landscape of contemporary journalism. The legitimizing strategies these actors utilize to establish their practices and the technological opportunities they leverage point to existing problems and challenges of professional journalism. They also provide insights for opportunities to address these problems and reform journalistic practices.

This chapter introduces newly emerged patterns of journalistic practices; examines tension among competing interests, priorities, and values among these social actors and journalists; and discusses challenges and opportunities for reforming professional journalism. This research reveals that scientist-led nonprofits Climate Central and Climate Feedback have built journalistic collaborations to promote scientific accuracy and accountability in climate reporting. These collaborations reflect the trend of increasing involvement of NGOs in the news making process (Powers, 2018). The active collaboration between scientist-led nonprofits and newsrooms also underscores the emerging pattern of co-production in climate journalism, blurring professional boundaries among scientists, journalists, and technologists (Lück et al., 2016).

Specifically, the practices of Climate Central and Climate Feedback reveal a new approach to fact-checking, distinct from traditional journalistic approach to fact-checking. Digital platforms such as Facebook are also entering the field of fact-checking by implementing content moderation mechanism and third-party fact-checking partnership. But these approaches taken by Facebook to address climate disinformation remain questionable, as for-profit incentives are built into Facebook algorithms, which prioritizes lucrative fossil fuel disinformation and propaganda. Data-driven practices like AllSides and Facebook also indicate the growing influence of algorithms and artificial intelligence in shaping news production, which normalizes the power of Silicon Valley actors over public discourse, while challenging the gatekeeping role of professional journalists.

Findings also suggest that the established professional norm of objectivity persists in emerging fact-checking practices. Yet the contextualized approach of producing and communicating climate science also represents a new kind of objectivity that is pluralistic in

interpretations. Moreover, although professional journalistic expertise remains irreplaceable in these data-driven practices, the legitimacy of journalists is constantly contested in boundary negotiations with emerging social actors. The rise of digital platforms and elevation of audience centered values bring challenges to epistemic authority of journalists and make it possible for Silicon Valley actors to leverage new professional values like transparency to reinforce their legitimacy in the public discourse. The challenges from Silicon Valley actors also highlight the struggle of journalists in balancing market pressure of generating revenue and civic obligations of serving public interest.

Drawing from these emerging practices, this chapter discusses potential pathways for reforming professional journalism. First, we should reimagine the institutional boundaries of journalism to include hybrid forms of news making and social actors who have resources and expertise to produce high-quality climate information. Second, we need to reconsider implications of the shifting information ecosystem on journalistic roles, norms, and practices. Third, we need to reckon with historical and structural vulnerabilities of journalism. This requires incorporating the climate justice approach through diversifying journalistic collaborations and sources, strengthening locally focused and public interest-oriented climate journalism, and reforming profit-driven business models of journalism.

Essentially, in processes of establishing legitimacy and leveraging technology, emerging practices addressing climate disinformation reveal that public knowledge about climate change is not produced by static institutions, organizations, or professions with fixed boundaries and set norms. Instead, climate knowledge is produced by heterogeneous networks of actors of scientists, NGOs, activists, technologies, and even non-human actors of algorithms. Examining these emerging patterns of co-production responds to the ongoing scholarly conversation about

repositioning climate journalism in networks where heterogeneous actors collectively produce climate knowledge (Kunelius, 2019; Painter et al., 2024; Russell et al., 2023). It also contributes to research on journalistic boundary work by reconceptualizing journalism as a "hybrid" and "complex social structure" rather than a norm-based, stable institution with fixed boundaries (Carlson & Lewis, 2020; Chadwick, 2017; Reese, 2022).

Chapter 5. Conclusion

The Changing Faces of Legitimacy

Throughout this dissertation, I have explored how emerging social actors, including scientist-led nonprofits, Silicon Valley entrepreneur-founded media company, and digital platform build their practices attempting to address the systematic problem of climate disinformation. By examining the processes in which these actors employ strategies to establish legitimacy and leverage technology in these practices, I found that these practices all need to navigate social, political, and cultural forces that together enable the epistemological rift in public consensus about what constitutes fact and who has the legitimacy to produce and represent public knowledge. For actors vying to shape public discourse about climate change, establishing legitimacy is a central concern because it sets the epistemic foundations for what knowledge, authorities, and solutions are to be trusted and acted upon. As scientists, journalists, and technologists actively construct, defend, and challenge boundaries of climate knowledge production, they struggle over who gets to define trustworthy climate knowledge and what knowledge-ways are perceived as credible and authoritative in the public eye.

The processes by which Climate Central, Climate Feedback, AllSides, and Facebook establish legitimacy reveal how these different social actors assess, validate, and represent knowledge in public discourse. Understanding these processes not only illuminates the multifaceted dimensions of legitimacy; it also highlights that legitimacy is neither inherent nor static. Rather, legitimacy is constructed through culturally specific institutional norms, practices, and power dynamics. Therefore, legitimacy of shaping public discourse about climate change is in constant contestation, negotiation, and adaptation. Through framework of civic epistemology, this research examines how culturally specific knowledge-ways of various social actors shape the

strategies they use to distinguish their practices as legitimate knowledge practices. While scientists emphasize academic credentials and institutional authorities to reinforce boundaries of scientific knowledge production; technologists frame digital tools as neutral and democratizing forces and elevate new professional values to expand the boundaries of public knowledge.

The distinct strategies of building trust, establishing expertise, and demonstrating practices not only reflect distinct professional norms, values, and cultural assumptions of these social actors; they also highlight the necessity of engaging with diverse epistemological frameworks to construct effective interventions to climate disinformation. Indeed, these distinctive ways of knowing shape the epistemological basis of collective social decision making: how different social actors understand what evidence is evaluated, what method is considered reliable, and what transparency means in the process. What climate scientists perceive to be the key to defend expertise and authority as public knowledge producers, such as committing to scientific objectivity and strengthening the accuracy of scientific facts, might not carry equal weight for technologists. Therefore, understanding diverse and culturally specific interpretations of legitimacy across different social domains is crucial for developing systematic, grounded, and context-specific approaches to effectively counter climate disinformation.

The contested nature of legitimacy in producing and representing public knowledge means intervention strategies to counter disinformation need to account for shifting dynamics of the networked information environment. The consensus on climate change is well established in scientific communities but remains politicized in public discourse, partially due to the hybrid, fragmented and polarized information environment. As digital technology transforms how knowledge is created, shared, and consumed, it also shifts power relationships among scientists, journalists, and technologists. The decentralized, participatory, and increasingly algorithmic

driven information system has weakened traditional gatekeeping structures and challenged traditional knowledge authorities and hierarchies, forcing various social actors to renegotiate their legitimacy.

In the past, scientists relied heavily on institutional authority and expertise to defend their legitimacy, such as traditional boundary markers of peer review, academic credentials, and institutional affiliations. However, the shifts brought by digital technology have impacted these traditional markers of scientific expertise and authority, including increasing participatory forms of knowledge production and widely used digital platforms and algorithmic amplification in information distribution and consumption. Scientists now must actively engage with digital audiences, employ networking tools, and adapt communication strategies to maintain their legitimacy in the public discourse. Climate Central and Climate Feedback both employ strategies like building partnerships with newsrooms and digital platforms to foster public trust, and leveraging social media affordances and technological tools to increase visibility. These trust-building strategies, digital savviness, and public engagement efforts all point to the strategic negotiation of scientific legitimacy in the era of contested scientific knowledge production.

Meanwhile, digital technology also enables Silicon Valley actors to control the resources and means for digital production and thus project their technological vision of legitimacy to shape public discourse. Whether it is entrepreneurial media company like AllSides or established tech giant Facebook, these tech actors all emphasize transparency, technical innovation, and data-driven decision-making, and frame their platforms and algorithms as objective tools rather than active participants in shaping discourse. Through adjusting and framing content moderation policies and employing narratives about tech neutrality and algorithmic objectivity, Silicon Valley actors often portray themselves as forward-thinking visionaries providing innovative tech-

driven solutions to global challenges like climate change. However, these actors also constantly negotiate and recalibrate legitimacy in response to public scrutiny and regulatory pressures over algorithmic biases, disinformation amplification, and market-driven business models that privilege profit and engagement over accuracy of information and social responsibility.

For journalists, the legitimacy of shaping public discourse has already been contested. Unlike scientists, who derive legitimacy from institutional expertise and established boundary enforcing devices, or technologists, who gain credibility through infrastructure control and data ownership, journalists operate in the intersection of political, economic, and technological forces. As mediators of climate science and communication, the authority of journalists to represent legitimate public knowledge must be constructed through ongoing negotiations with other social actors in an expansive network of power dynamics (Carlson, 2017). In the digital information environment, the boundaries between journalists and nonjournalist news makers are further blurred, posing challenges to traditional gatekeeping authority of journalists. The rise of Silicon Valley actors and their ambition to procure power in shaping public discourse, particularly, target on challenging established journalistic professional norms such as objectivity.

The efforts of Climate Central, Climate Feedback, AllSides, and Facebook to build their practices as potential solutions to climate disinformation all underscore the central issue of legitimacy. In the broader context of the post-truth era, the struggle for legitimacy in producing and representing climate knowledge is more than a matter of reinforcing scientific facts; but a matter of power, influence, and authority in shaping public perceptions about what counts as credible knowledge and how important policy decisions and collective actions should be made. As this research suggests, legitimacy is shaped by culturally specific epistemologies of different

social worlds; and it needs constant articulation, negotiation, and adaptation in competitive and dynamic processes.

The Gains and Losses of Legitimacy

The processes in which different actors negotiate legitimizing strategies also reveal competing choices, priorities, and values among various social actors. Since legitimacy is constantly contested and negotiated, the processes of obtaining legitimacy inevitably come with gains and losses. For these actors, pursuing legitimacy can offer power, trust, and influence, but it may also risk autonomy, flexibility, and integrity. Examining gains and losses associated with these choices, priorities, and values, this research tries to illuminate power struggles and ethical implications in the processes of pursuing legitimacy, thus contributes to more nuanced understanding of how expertise and authority are perceived in climate communication.

One of the key legitimizing strategies for Climate Central and Climate Feedback is building partnerships with media outlets. These collaborations offer benefits for both scientist-led nonprofits and news organizations. For instance, the Partnership Journalism program allows Climate Central to co-produce news stories highlighting climate impact with local newsrooms. The involvement of Climate Central is highly integrated in the collaboration process as they do not just contribute to providing scientific "data and charts", but also "story and interview suggestions and help develop and review scripts"[67]. These partnerships help these nonprofits translate complex scientific information into accessible narratives accessible to a broader audience, increasing influence and promoting public engagement with climate science.

Likewise, partnering with scientist-led nonprofits empowers journalists with access to expert knowledge, credible data, and specialized resources. Scientist-led nonprofits like Climate

[67] Climate Central. (n.d.). *Partnership journalism.* Climate Central. https://www.climatecentral.org/partnership-journalism

Central and Climate Feedback have the capacity of conducting original research, evaluating climate-related information with scientific expertise, and providing science-backed data and illustrations. Their involvement in the news making process can help journalists strengthen scientific accuracy and reliability of climate reporting. These well-funded organizations can also provide extensive resources and tools for newsrooms, especially local newsrooms struggling with declining revenue to expand the scope and depth of climate coverage without being restrained by market pressure. Climate Central's Partnership Journalism program, for example, provides scientific expertise, research support, and even interview advice for local newsrooms to cover in-depth climate stories.

The increasing participation of scientist-led nonprofits in producing and disseminating climate information also contributes to reshaping traditional boundaries of journalism by bringing in new norms, values, and relationships to journalistic practices. The emerging pattern of co-production among scientists, journalists, activists in climate journalism reveals shared commitment to producing and disseminating quality information about climate change to the public (Russell et al., 2023). The co-productive relationships among scientist-led nonprofits, journalists, and tech professionals expand the realm of climate journalism by making scientists prominent voices, strengthening scientific accuracy and accessibility of climate reporting, and building stronger connections among climate scientists, journalists and the public.

However, the blurred institutional boundaries among science, journalism, and advocacy not only facilitate mutually reciprocal relationships; tension arises when competing interests, priorities, and role perceptions of heterogenous actors interact. Despite their scientific expertise and reporting resources, science nonprofits like Climate Central and Climate Feedback may not live up to the ideal of public interest climate journalism. Founded by elite scientists and wealthy

donors, the communicative strategies and organizational agenda of these nonprofits are heavily shaped by values and interests of these elites. Funding support and organizational incentives shaped by donors such as tech platforms and foundations could potentially drive priorities of these organizations to cater to elite audiences. For example, the accountability discourse of these nonprofits is often "articulated in corporate terms", which reinforces market logic that hollows out discussions about deeper public accountability issues (Powers, 2018, p. 162). This is especially prominent in the case of U.S. based Climate Central, which emphasizes the "impact" and brand building of the organization in public communication efforts.

More importantly, the competing priorities in negotiating legitimacy can also present challenges to effective interventions of climate disinformation. Another key legitimizing strategy for scientist-led nonprofits is to focus on policy neutrality and scientific objectivity. As Hayhoe (2022) argues, in the polarized political environment, it is potentially helpful for climate scientists to be seen as neutral and apolitical to inform and persuade audiences who are on the fence about accepting climate science without triggering contentious polarizing politics. However, neutrality and objectivity has long been abused by disinformation agents to manipulate media agenda and perpetuate power inequalities. A growing number of climate scientists since argue that neutrality in climate communication is both unattainable and undesirable (van Eck et al., 2024),

In fact, the persistent beliefs in objectivity and neutrality among these scientist-led organizations indicates a problematic long-running cultural pattern in the scientific knowledge production. Since the 1980s, feminist science studies scholars like Haraway (1988) and Harding (1991) have questioned the doctrine of objectivity as it situates scientific knowledge in service of masculine, white, and heterosexual hierarchical social orderings. The impartial, value-neutral

objectivism functions as a key strategy for Western elites to absolve from responsibilities of origins, procedures, and consequences of science and the "interests, desires, and values they promote" (Harding, 1991, p. 3). The "real science" produced under the guidance of objectivism, including hypotheses formulation, conceptualization, and methodological procedure, excludes access and contributions of those who are identified as inappropriate and irrational (Harding, 1991). The pursuit for objectivity and neutrality could exclude legitimate perspectives and experiences deemed "inappropriate" or "irrational" under the paradigm of objectivism in science production.

Therefore, the ideal of scientific neutrality and objectivity is deeply rooted in historical exclusion and marginalization of minority perspectives. These ideals could set back necessary efforts to confront challenges of climate disinformation, as practices guided by these ideals fail to account for social inequalities and vulnerabilities among "power-differentiated communities" (Haraway, 1988). The experiences of frontline communities who disproportionately suffer from the climate crisis are more likely to be depoliticized and marginalized, perpetuating historical injustices and structural inequalities. Effective interventions to climate disinformation requires us to recognize the unequal power dynamics in climate knowledge production and dissemination and collectively imagine fair, just, and effective solutions. These imaginaries could not be complete without holding powerful industries and actors accountable. For scientist-led fact-checking organizations, the emphasis on organizational guiding principles of nonpartisanship and policy neutrality could limit their abilities to build alliance with frontline activist groups, give voices to disproportionally affected communities, and effectively engage broader audience to address the climate crisis.

The limitations of neutrality can be especially pronounced in partnership programs built by scientist-led fact-checking nonprofits with news organizations and digital platforms. Climate Central's active role in the journalism partnership may also potentially compromise journalistic autonomy and independence, as these interactions could interfere with professional judgments in climate reporting. Climate Central's neutrality policy stance could potentially influence the reporting process by driving climate stories to be depoliticized as reporters feel pressured to refrain from engaging in climate policy debates. But policy deliberation is essential for effective interventions to climate disinformation because it provides space for contesting false narratives, reinforcing scientific consensus, and informing evidence-based climate decision-making and action.

Similarly, Climate Feedback's fact-checking partnerships with Facebook also reveals limitations of legitimizing strategies of scientist-led nonprofits. Climate Feedback, as a third-party fact-checking partner for Facebook, evaluates controversial claims about climate change circulating on the platform. This partnership has been marketed by Facebook as an essential part of its efforts in combating climate disinformation. For Climate Feedback, besides direct revenue from the commercial partnerships with digital platforms[68], the role of an independent third-party fact-checker helps establish them as a credible source for scientific information that also have access to intervene in debunking climate disinformation on widely used platforms.

However, despite the intention of combating disinformation on the "frontline" of platforms, Climate Feedback's role as a neutral and independent third-party fact-checking partner might practically provide political convenience for platforms like Facebook to evade more strict oversight and regulation. In fact, asymmetric power dynamics are often embedded in these fact-

[68] Science Feedback. (n.d.). *Partners, funders & donors*. Science Feedback. https://science.feedback.org/partners-funders-donors/

checking partnerships (Bélair-Gagnon et al., 2023). Platforms not only own and control algorithms and data access; they also delegate content-related responsibilities to third-party fact-checking intermediaries who has no power in rulemaking (Medzini, 2022). As Climate Feedback points out, fact-checking partners do not have access to Facebook's content decision-making process.

The asymmetric power dynamics in fact-checking partnerships also shape priorities of which claims get to be verified and which stories get to be investigated. Platforms also set targets for fact-checking partners to accelerate the fact-checking process, which often leads to prioritization of information that can be easily checked (Bélair-Gagnon et al., 2023). As discussed in Chapter 3, fact-checkers partnering with Facebook often prioritize verification of highly visible and viral content over other forms of harmful and deceptive content. Prioritizing expediency, visibility, and virality of claims could divert attention of fact-checking partners away from politically complex claims and content, which might have more significant impact on public discourse (Cotter et al., 2019; Vinhas & Bastos, 2023).

More problematically, these platform fact-checking partnerships are vulnerable to platform content policy changes, which are often reactive and contradictory. In January 2025, the parent company of Facebook, Meta swiftly announced the termination of the third-party fact-checking program. The abrupt end of these fact-checking partnerships has left many long-term partnering organizations blindsided, leading to concerns about financial stability, operational capacity, and ongoing efforts to address climate disinformation (Leingang, 2025).

The fickleness of Facebook's content moderation policies, however, does not come as a surprise. The third-party fact-checking program was born out of Facebook's response to widespread public criticism and regulatory pressure regarding the platform's role in electing

Donald Trump in 2016 U.S. presidential election. Facebook's most recent decision of replacing its fact-checking program with a user-driven "Community Notes" model is a broader effort to realign with the political right and cater to the political climate of the Trump administration. Facebook's inconsistent content policies reveal that platform moderation mechanisms both shape and are shaped by competing political ideologies and market interests. Yet these content decisions are inherently political, as they influence whose voices are amplified, which narratives are legitimized, and what issues are prioritized on the public agenda.

Legitimizing strategies employed by Silicon Valley actors like AllSides and Facebook, including privileging transparency value and exploiting abstraction of digital systems, allow them to retain control over algorithms, data policies, and content moderation decisions, thus justify their role in shaping public discourse. By relying on these legitimizing strategies, AllSides presents its media bias rating system as a "transparent" and "balanced" mechanism of organizing public knowledge. Facebook deflects public scrutiny from inherent biases in algorithms, platform design, and content moderation mechanism. However, these legitimizing strategies have profound long-term impact on public trust in social knowledge production beyond immediate content decisions, as these strategies shape how authority, expertise, and regulatory governance evolve over time.

Essentially, the choices, priorities, and values of various legitimizing strategies and the gains and losses that come with them highlight broader societal tension in addressing climate disinformation: should scientists still prioritize scientific objectivity and policy neutrality, even at the risk of excluding and marginalizing vulnerable population? Should journalists and scientists embrace tech partnerships, even when they are vulnerable to shifting platform policies, political pressures, and the prioritization of profit over truth? These dilemmas underscore tension among

authority, accountability, and adaptability in negotiating legitimacy. Examining gains and losses of legitimizing strategies reveals that there is no single institution or approach sufficient for addressing climate disinformation. Instead, we need to reimagine institutional arrangements that incorporate diverse epistemological approaches of scientists, technologists, and journalists and balance competing interests and values among these actors.

Reimagining Institutional Arrangements

The three approaches addressing climate disinformation, including institutional fact-checking, media literacy, and platform regulation all engage with certain dimensions of social, political, and cultural contexts that contribute to the epistemological rift, fracturing public consensus on climate science and solutions. The institutional fact-checking approach of Climate Central and Climate Feedback provides insights for repairing fractured public consensus on what constitutes as facts about climate change. The media literacy intervention of AllSides and self-regulation approach of Facebook highlight the rapidly changing information environment that shapes what the public agrees to be credible knowledge and who has the legitimacy to produce and represent public knowledge. Therefore, understanding the processes in which these social actors legitimize their approaches also provide opportunities for reimagining what institutional arrangement are best poised to promote truthful information and foster public trust in the shifting digital media ecosystem.

The cases of Climate Central and Climate Feedback reveals both strengths and limitations of the expert-driven, research-based fact-checking intervention. On one hand, fact-checking reinforces the institutional expertise of climate scientists in verifying climate claims, producing rigorous research, and adapting scientific findings to broader audiences. On the other hand, the fact-checking approach also underscore the limitations of relying on factual accuracy and

scientific expertise to counter climate disinformation. While scientific fact-checking helps ensure that climate claims are rigorously vetted and evidence-based, these messages often struggle to overcome the political, ideological, and emotional appeals of climate disinformation.

The legitimizing strategies of building media partnerships and contextualizing science, and technological tools they use highlight the necessity of incorporating public engagement efforts in communicating climate science. Programs like Climate Central's Journalism Partnership provide valuable lessons for engaging the public through producing interactive scientific content, community focused stories, and supporting media partnerships. These collaborations help bridge the gap between expert knowledge and public perception, making climate science accessible, relatable, and credible. Eventually, they help scientist fact-checkers reinforce scientific expertise when public distrust in institutions continues to contest their legitimacy as knowledge producers. These strategies also implicate that public engagement should be integrated into the incentive structures of scientific research by valuing and rewarding science communication activities that enhance trust, accessibility, and relevance of climate research.

Another challenge for scientist fact-checking approach is that the efficacy of their intervention also largely depends on platform content policies, algorithmic transparency, and the priorities of profit-driven tech companies. While scientist-led organizations like Climate Feedback built fact-checking partnerships with widely used digital platforms like Facebook, such arrangements raise questions about lack of transparency and inconsistencies in policy enforcement. Like mentioned earlier, platforms can implement or withdraw content policies at will, driven by shifting public pressure, political interests, and profit-driven engagement metrics.

Such inconsistencies expose power imbalances in tech partnerships, as scientist fact-checking partners lack the power and influence over important platform content enforcing mechanisms.

At the same time, inconsistencies of platform content policies are also structural features of the profit-driven model of platforms that commodifies user data, incentivizing platforms to align moderation policies with corporate interests and state power rather than democratic norms. Facebook's self-regulatory measures of curbing climate disinformation in many ways are performative PR tactics to sidestep public scrutiny over deeper accountability issues. Indeed, we have to consider the fact that climate deniers and propagandists have disproportional influence on Facebook when examining the lackluster self-regulatory efforts of the platform. Not only does the company profits from paid fossil fuel advertising, the design of engagement-reinforcing algorithms also amplify the visibility and spread of fossil fuel funded content of climate denial and skepticism. As Russell (2023) points out, the proliferation of climate disinformation on Facebook is inseparable from its design, policy, and practices that encourages and promotes climate disinformation.

We must also recognize that privately owned digital platforms cannot and should not be expected to serve the best interest of healthy, robust, and truthful public discourse. As Zuboff (2021) points out, resorting to self-regulation efforts of Big Tech as a solution to climate disinformation is akin to trusting social responsibility campaigns of Big Oil. Facebook's content moderation, rather than safeguarding public interest and addressing pressing problems of disinformation, allows platforms to evade public oversight with performative transparency and selective enforcement, hence leaves decisions with profound social and political impact in the hands of monopolistic private entities with no democratic accountability.

In fact, Facebook's most recent decision to replace third-party fact-checking with a community-based system signals a shift of moderation responsibility away from institutions toward individuals. The shift exemplifies the techno-libertarian vision of Silicon Valley actors that focuses on minimalizing centralized intervention and institutional oversight.

Like Facebook, Silicon Valley media company AllSides's media literacy intervention is also predicated on techno-libertarian vision of individual empowerment through exposures to diverse perspectives powered by algorithmic logics. For AllSides, the declining public distrust in traditional knowledge authorities such as professional journalists also create opportunities to establish itself as legitimate public knowledge purveyors and project their ideologies and values to reshape the public discourse.

AllSides's media bias ratings not only directly target on journalistic judgement as an inherently flawed and unreliable social mechanism to represent public information. Its techno-libertarian vision of purveying public information provides false balance to legitimize and amplify climate conspiracy theories and fossil fuel propaganda, which could further undermine public trust in climate science. Yet AllSides's legitimatizing strategy of prioritizing transparency does illuminate structural problems that have long plagued legitimacy of professional journalism. The long running professional norm of objectivity in journalistic practices has implicated journalism in exposing its detachment from representing experiences and perspectives of underserved communities. Moreover, journalistic dependence on elite sources and authority voices, and the dominating for-profit corporate media system has bred anti-establishment skepticism and deepening distrust in public institutions and professional knowledge producers.

Meanwhile, emerging tech-driven practices examined in this dissertation also illuminate opportunities for professional journalism. The legitimizing strategies employed by climate

scientists, tech entrepreneurs, and digital platforms point to the contested boundary space of public discourse that professional journalists have sought to defend their traditional epistemic authority. The technological tools and opportunity structures leveraged by these social actors shed light on new dynamics shaping journalistic practices. But most importantly, they all point to the fact that professional journalism remains an irreplaceable force in exposing fossil fuel funded disinformation campaigns, bridging climate science and the audiences, and empowering marginalized communities by connecting issues of racial and environmental justice to the climate crisis.

For journalism to better serve its social functions of guarding public interests and speaking truth to power, we need to acknowledge the long-standing structural weakness of journalism and reform ingrained norms that have undermined public trust in journalism, such as objectivity and balance. We also need to redefine the legitimacy of journalistic sources and strengthen voices of scientists, activists, local communities, and underrepresented groups (Callison & Young, 2019; Fenton et al., 2020). Eventually, we need to reimagine the institutional boundaries of journalism to accommodate new actors and facilitate interactions and co-productive relationships that contribute to stronger public interest journalism (Kunelius, 2019; Russell et al., 2023).

Climate disinformation remains one of the most pressing problems to effectively address the climate crisis. Addressing climate disinformation requires assessing multifaceted social, political, and cultural forces that shape the creation, dissemination, and reception of climate disinformation. This dissertation examines emerging tech-driven practices grounded in various perceptions of the underlying causes of the problem and solutions best suited to address it. These practices, representing three prevalent approaches to address climate disinformation, provide

insights for understanding the shifting landscape of climate communication, the difficulties of bridging epistemic fractures in social and political consensus, and potential pathways for reforming journalism.

With the return of the Trump administration, renewed efforts to dismiss climate science and promote fossil fuel-funded climate denial and propaganda are already escalating. It is more important than ever for researchers to continue exploring systematic solutions to climate disinformation. As this research indicates, we cannot rely on one single approach or institution to address a problem that is a confluence of multiple social, political, and technological forces. Instead, we need structural interventions that incorporate diverse epistemological frameworks and build alliances across communities of science, technology, and journalism.

While this dissertation provides in-depth analysis and insights about emerging climate disinformation interventions, certain limitations should be acknowledged for the purpose of providing transparent interpretations of the findings. First, this research relies on purposive sample of case studies. While this approach allowed for deep engagement and in-depth exploration, the focus on a small number of cases makes it difficult to generalize findings to broader settings. Future research could explore alternative research methods that provide a broader scope and generalizable findings. Second, I use interpretive analysis for this research because my research goal is to develop deep understanding of these cases, which may introduce subjectivity in data selection and interpretation. My own background, experiences, and research interest could present biases in my interpretation of data. Throughout the analysis, I used reflexivity measures, such as memo-writing and peer debriefing to mitigate potential biases. Finally, this research focuses on climate disinformation intervention efforts of three groups of professionals, including scientists, tech entrepreneurs, and digital platforms in the contexts of

western democratic societies. Future research could expand the research scope to incorporate broader stakeholder perspectives in non-western contexts.

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Appendix A: Information about Interviewees

Case 1: Climate Central

Interviewee name: Peter Girard

Position: VP for External Communications

Profile information: Peter Girard leads digital communications and media relations for Climate Central. His previous experience includes heading research, audience development, and public relations efforts for a prominent Everglades restoration non-profit and political advocacy, following more than ten years leading marketing and communications programs for early-stage marketing technology providers and public companies. He began his career as a journalist covering ecommerce and database marketing technology. He holds a B.A. in English from St. Lawrence University.[69]

Case 2: Climate Feedback

Interviewee name: Nikki Forrester

Position: Science Editor, Climate

Profile information: Nikki holds a PhD in ecology and evolutionary biology from the University of Pittsburgh where she studied plant-bacterial interactions. As a freelance science writer, she covers climate, ecology, evolution, and research news. Her work appears in Nature, Science, the St. Louis Post-Dispatch, and other outlets.[70]

Case 3: AllSides

Interviewee name: Julie Mastrine

Position: Director of Marketing and Media Bias Ratings

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[69] Climate Central. (n.d.). *Peter Girard.* Climate Central. https://www.climatecentral.org/what-we-do/people/peter-girard

[70] Science Feedback. (n.d.). *Nikki Forrester.* Science Feedback. https://science.feedback.org/author/nikki-forrester/

Profile information: Julie is AllSides' Director of Marketing and Media Bias Ratings. She has written extensively on the topic of media bias. Julie was previously a spokeswoman and PR advisor for political advocacy campaigns. In this role, she crafted campaign messaging and worked directly with reporters to promote political advocacy campaigns in the press. This experience led her to become concerned about the ways political bias permeates journalism, and fueled her desire to analyze and educate about media bias. She studied Journalism and Public Relations at Penn State University. Julie says she believes in "being a responsible member of the media who elevates truth and critical thinking."[71]

[71] AllSides. (n.d.). *Julie Mastrine.* AllSides. https://www.allsides.com/news-source/julie-mastrine-media-bias

Appendix B: Interview Protocol

Sample Case: Climate Central

Thanks for accepting my invitation. I'm really grateful. I've been following Climate Central for a while and it's really great to be able to talk to someone who works at Climate Central. Before I start the interview, I want to ask for your approval of recording this interview for research analysis purpose.

General Background

1. Let me start off by asking some of your information. Can you tell me a little bit about yourself and your position at Climate Central?

2. Could you elaborate a little more on your past educational experiences and professional trajectory?

3. How did you come to know about Climate Central? What motivates you to want to join it, to work for it?

4. So far, how would you describe your experiences working at Climate Central?

Organization

5. Could you give me a brief overview of the organizational structure of Climate Central. What is the personnel composition? What are some of the major programs?

6. Who is the major targeted audience for Climate Central? Who are you speaking to?

7. How is Climate Central funded? What are the funding sources?

Norm/ Values & Cultural Assumptions

8. I want to talk about some of the values listed on the website. For example, effective communication. It says, "an innovative mix of science and communication, scaled by technology, defines your approach to reach and move important audiences". How does this play out in the work that Climate Central is doing?

9. What is the biggest challenge of science communication, particularly climate communication?

10. How do you perceive the relationship among science, journalism, and technology? As you mentioned, Climate Central has climate scientists, journalists, data person, etc. Do you think their professional backgrounds influence the work they are doing at Climate Central?

11. I also want to talk about policy neutrality. How do you maintain neutrality and why is that an important value to you?

Partnership Journalism

12. I want to know more about the Climate Matters Program. How was it started?

13. I noticed the focus is on local journalism, local media outlets. Can you explain why the focus is on media outlets/journalists on the local level?

14. How does this partnership work? Do you work directly with these reporters? Like being a part of their reporting/writing/editing process?

15. What's the goal of this partnership journalism initiative? What do you want to achieve with this partnership?

16. How would you describe the relationship between Climate Central and these news organizations?

Tech & Disinformation

17. I'm really interested in this data-driven, visualizing storytelling method that Climate Central uses. I actually came across this visualized presentation of the impact of sea level rise on major cities, made by Climate Central, circulating on Chinese social media. And I recognized it because I've seen it in Climate Central's newsletter. So I'm curious what is the reason that Climate Central decides to use these big data driven visuals in climate reporting?

18. Who produces these graphs, charts, multimedia visuals? What does the process look like?

19. I study climate disinformation. I'm also interested in potential solutions to address this issue. What do you think is the most fundamental obstacle for addressing climate disinformation?

20. I also want to know what you think, what are the obstacles for climate science communication? So essentially, what is in the way between effective communication between journalists and scientists?

21. Do you think Climate Central will help alleviate the spread of false information about climate change? What's role it plays in solving this problem of climate disinformation?

22. What do you think of the efficacy of the Climate Central's data driven approach in addressing climate disinformation?

23. To effectively counter the climate disinformation, what other methods and approaches do you think should be taken?

Success & Failure

24. Can you talk to me a little bit about an example of like, a success? How do you know, what you're doing is, a particular project or partnership or whatever is a success?

25. Can you tell me about a project that didn't work the way you wanted it to or, you would consider a failure?

26. Is there anything else that I didn't ask about that's essential to the work you do at Climate Central?

That's all the questions I want to ask. Thank you very much. I really appreciate your time.

Appendix C: List of Primary Sources Used for Data Analysis

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