

Digital echo chambers in emergencies: How social media amplifies polarization during health and disaster events

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Abstract

This article examines the pervasive influence of social media platforms in amplifying polarization during emergency situations, including health crises, natural disasters, and armed conflicts. Drawing on a comprehensive review of current peer-reviewed literature and credible reports, it defines digital echo chambers and distinguishes them from filter bubbles, elucidating the psychological and algorithmic mechanisms that foster their formation. The article provides in-depth case studies, particularly focusing on the COVID-19 pandemic, to illustrate how echo chambers facilitate the spread of misinformation, erode public trust, and undermine collective action. Further analysis extends to natural disasters and armed conflicts, demonstrating how polarized narratives disrupt emergency response efforts and exacerbate societal divisions. The discussion synthesizes cross-cutting themes, highlighting the complex interplay of human behavior and technological design. Ultimately, the article underscores the urgent need for coordinated efforts among platforms, policymakers, and communicators to mitigate the detrimental impacts of digital echo chambers during crises, promoting information diversity and rebuilding shared understanding.

Keywords: Digital Echo Chambers; Social Media Polarization; Health Communication; Disaster Misinformation; Crisis Communication; Online Discourse

1. Introduction

1.1. The Pervasive Role of Social Media in Modern Crises

The advent of the internet and Web 2.0 has profoundly reshaped the global information landscape, transforming how individuals access news and engage with public discourse.¹ Social media platforms, in particular, have emerged as dominant conduits for information dissemination, with a significant portion of the global population relying on them for news. For instance, in 2023, approximately half of all adults in the United States reported regularly consuming news content on platforms such as Facebook.³ This widespread adoption has endowed social media with an unprecedented capacity to rapidly disseminate information to billions of users worldwide, fundamentally altering the dynamics of communication during critical events.⁴

During emergencies, this pervasive reach offers distinct advantages. Social media platforms serve as vital communication channels, enabling the real-time sharing of situational updates, facilitating the mobilization of relief efforts, and fostering direct communication among affected populations, emergency services, and the broader community.⁶ They allow individuals to seek and share help, report their status, and receive crucial updates from response organizations, often overcoming challenges faced by traditional communication infrastructure during disasters.⁷ However, the very mechanisms that enable this rapid and broad dissemination also introduce substantial

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risks. The same channels that transmit vital information can simultaneously amplify false narratives, exacerbate existing societal divisions, and undermine coordinated crisis response efforts.²

1.2. Defining Digital Echo Chambers and Polarization in Emergency Contexts

To comprehend the detrimental effects of social media during crises, it is imperative to define two central concepts: digital echo chambers and polarization. A digital echo chamber is an online environment where individuals primarily encounter beliefs that reinforce their pre-existing opinions through a process of communication and repetition within a closed system, largely insulated from rebuttal.⁹ This phenomenon is driven by a natural human tendency to gravitate towards like-minded individuals and content, leading to a homogenous information diet.¹ Within such a chamber, existing views are circulated without significant exposure to opposing viewpoints, potentially fostering cognitive biases such as correlation neglect, selection bias, and confirmation bias.⁹

Polarization, in the context of social media, describes a societal condition where individuals are divided into two distinct subgroups on a particular issue, holding conflicting and often extreme views with minimal common ground.¹² This division extends beyond mere disagreement, often leading to a perception that the opposing side is not merely different, but "worse" than one's own.¹² A defining characteristic of polarization is the notable absence of "bridging" efforts, meaning there is little to no inclination for individuals from opposing groups to engage with or learn from each other, or to seek collaborative solutions.¹²

The relevance of these phenomena intensifies dramatically during emergencies. In times of crisis, the amplification of pre-existing beliefs and the entrenchment of opposing viewpoints within digital echo chambers can severely undermine collective action, erode public trust in authoritative institutions, and significantly impede the effectiveness of crisis response efforts.¹⁴ The high stakes and urgency inherent in emergency situations make accurate, unified, and widely accepted public responses critical. When information environments are fragmented by echo chambers, achieving such unity becomes profoundly challenging, potentially prolonging crises and exacerbating their human and societal costs.¹⁵

1.3. Article Structure and Scope

This article systematically examines the intricate mechanisms through which social media platforms contribute to the formation and reinforcement of digital echo chambers and, consequently, to societal polarization during various emergency situations. The analysis is structured to provide a comprehensive understanding, beginning with a conceptual framework that delineates the distinctions between echo chambers and filter bubbles, and explores the psychological and algorithmic underpinnings of their formation. Subsequent sections delve into specific case studies, with a primary focus on health emergencies, particularly the COVID-19 pandemic, to illustrate the real-world societal and behavioral consequences of these phenomena. The scope extends to natural disasters and armed conflicts, demonstrating how polarized narratives disrupt emergency response efforts and exacerbate societal divisions across diverse crisis contexts. The discussion synthesizes cross-cutting themes, highlighting the complex interplay of human behavior and technological design. All analyses and examples are rigorously confined to peer-reviewed studies, credible reports, and currently available data. Visual data, such as tables, are integrated where they enhance the clarity and impact of the arguments.

2. Conceptual Framework: Mechanisms of Digital Echo Chamber Formation and Polarization

2.1. Distinguishing Echo Chambers from Filter Bubbles

While often used interchangeably in popular discourse, the academic understanding of "echo chambers" and "filter bubbles" reveals important distinctions in their underlying mechanisms, even as both contribute to the problem of information segregation and polarization.

An echo chamber is fundamentally an environment where individuals primarily encounter information and opinions that reinforce their pre-existing beliefs, often through communication and repetition within a relatively closed system.⁹ This phenomenon is metaphorical, drawing from the acoustic concept of sounds reverberating in an enclosed space.⁹ A key characteristic is the active exclusion and discrediting of opposing views. Individuals within an echo chamber become dependent on internal sources and highly resistant to any external information that challenges their established worldview.⁹ This active dismissal of outside voices, even when heard, strengthens the internal consensus and reinforces individual belief systems.⁹

In contrast, a filter bubble, a term coined by internet activist Eli Pariser, describes a state of intellectual isolation that primarily results from algorithmic curation.⁹ In this scenario, a website's algorithm selectively guesses what

information a user would prefer to see based on their digital footprint, including location, past click-behavior, and search history.⁹ The critical element here is the non-transparent nature of these algorithmic choices, which effectively separate users from information that might contradict their viewpoints, thereby isolating them in their own ideological or cultural "bubbles".⁹

The primary distinction lies in the agency driving the phenomenon. Echo chambers are largely user-driven, reflecting individuals' active choices to associate with like-minded others and consume ideologically aligned content.¹ This self-selection leads to homogenous online groups where conflicting ideas are rarely encountered.¹ Filter bubbles, conversely, are primarily algorithmically driven, where content is curated based on a user's past activity, limiting the novelty and diversity of information they encounter.¹ Both, however, contribute to online clustering and polarization by limiting exposure to diverse perspectives.¹ For clarity in broader discussions, some academic works may use "echo chambers on social media" to encompass both concepts, recognizing their shared outcome of reinforcing pre-existing beliefs.¹

A significant implication of this distinction pertains to the robustness and permeability of these information environments. If an echo chamber is defined by the active exclusion and discrediting of external sources, it suggests a more entrenched and epistemically robust structure than a filter bubble. In an echo chamber, external voices are not merely absent; they are actively delegitimized, fostering a pre-emptive distrust among members towards any information originating outside their validated network.⁹ This systematic discrediting makes the internal belief system highly resistant to change, as members become critically dependent on internal sources and insulated from the validity of counter-evidence.⁹ Conversely, filter bubbles, while limiting exposure, might be less robust because the isolation is a passive consequence of algorithmic design rather than an active, cognitive rejection of external information. This suggests that interventions aimed at mitigating echo chambers may require more profound strategies than simply adjusting algorithms; they might need to address the underlying social and psychological dynamics of distrust that compel individuals to actively reject divergent viewpoints.

Table 1 Key Definitions in Digital Information Environments

Term	Definition	Primary Mechanism	Robustness/Permeability
Echo Chamber	An environment where beliefs are amplified/reinforced by communication and repetition within a closed system, insulated from rebuttal; active exclusion and discrediting of opposing views.	User-driven self-selection, homophily, active discrediting of external sources.	High robustness; members actively resist external information.
Filter Bubble	A state of intellectual isolation resulting from personalized searches, where algorithms selectively guess user preferences, isolating them from dissenting information.	Algorithmic curation based on user data (e.g., clicks, search history).	Potentially less robust; isolation is passive, not necessarily active rejection.
Polarization	Division of people into two distinct subgroups with conflicting, often extreme views, characterized by minimal middle ground and lack of bridging efforts.	Reinforced by both echo chambers and filter bubbles, exacerbated by cognitive biases and algorithmic amplification of extreme content.	High; leads to entrenched views and resistance to counter-evidence.

2.2. Psychological Underpinnings

The formation and persistence of digital echo chambers and the amplification of polarization are deeply rooted in fundamental human psychological tendencies, which are then exacerbated by the architecture and incentives of social media platforms.

One primary factor is homophily, the inherent human tendency to seek out and associate with others who are similar to oneself.¹² This phenomenon is observed across various aspects of life, from neighborhood segregation by race and class to social groupings based on shared lifestyles.¹² On social media, homophily translates into users connecting with like-minded individuals, forming social networks where shared beliefs and values are reinforced.¹² This natural inclination to group with similar others contributes significantly to the formation of ideologically homogenous online

communities.¹ For instance, studies on journalistic values on Twitter indicate that journalists tend to connect with other journalists who share similar professional values, further solidifying professional echo chambers, though ideological homophily was not found in that specific study.¹⁸

Confirmation bias is another critical cognitive bias at play. Individuals tend to seek out information that confirms what they already believe to be true, while simultaneously ignoring or downplaying information that contradicts their existing beliefs.⁹ When presented with diverse information, people are more likely to pay attention to narratives that support their existing viewpoints and disregard those that challenge them.¹² This selective processing reinforces existing beliefs and makes individuals more entrenched in their views, contributing directly to political polarization.¹⁹

Closely related are selective exposure and selective retention. Selective exposure refers to the active choice individuals make to consume information from sources that align with their existing viewpoints, even when a variety of perspectives are readily available.¹² This means people tend to prioritize reading agreeable content and avoid information that conflicts with their perspectives.¹² Even if individuals are incidentally exposed to information that challenges their views,

selective retention dictates that they are less likely to remember that information as readily as they recall information that supports their perspective, effectively making it seem as though the conflicting information was never encountered.¹² This behavior provides feedback to social media algorithms, which then further filter out content users are not engaging with, thereby reinforcing homophily and groupthink.¹²

Biased assimilation further intensifies this process. When individuals engage in research or read articles on an issue, they tend to interpret the information in ways that support their pre-existing viewpoints.¹² This leads to an overemphasis on the importance of supporting information, which is then often repeated to others as evidence of correctness, while contradictory evidence is undervalued or dismissed.¹² This cognitive process is driven by a motivation to defend existing attitudes and maintain a coherent worldview, which is frequently linked to personal identity, group affiliation, or emotional investment.¹⁹

Finally, groupthink describes a phenomenon where a group of people think similarly about an issue, leading to a lack of contradiction and intellectual challenge within the group.¹² When unchallenged, the group's thought process can spiral, pushing members further into their shared beliefs without being required to evaluate evidence or justify their positions.¹² This collective reinforcement can lead to increasingly extreme beliefs and heightened polarization.¹² The disinhibition effect on social media, combined with the prevalence of polarized, emotive discourse, often undermines the potential for constructive engagement with opposing viewpoints, further intensifying polarization by provoking strong emotional responses.¹⁹

The interplay of these psychological factors creates a powerful feedback loop on social media. Individuals seek out like-minded others (homophily), selectively consume and remember confirming information (selective exposure/retention, confirmation bias), interpret new information to fit their existing views (biased assimilation), and reinforce these views within their homogenous groups (groupthink). This process leads to increased ideological rigidity and resistance to counter-evidence, even when cross-cutting information is encountered.¹⁹ While some studies suggest that deliberate engagement with diverse viewpoints can foster understanding and reduce partisan hostility, this is often an active choice that runs counter to these ingrained psychological tendencies.¹⁹ The pervasive nature of these biases means that even when social media platforms expose users to more information and more quickly than ever before, users tend to avoid information that conflicts with their viewpoints.¹²

2.3. Algorithmic Amplification and the Attention Economy

Beyond individual psychological predispositions, the architecture and economic models of social media platforms play a critical role in the formation and amplification of digital echo chambers and polarization. These platforms operate within an "attention economy," where their primary objective is to capture and retain user engagement to maximize advertising revenue.¹³ This economic incentive drives the design of sophisticated algorithms that curate personalized content for each user.

These algorithms function as filtering devices, creating an individual "informational ecosystem" or filter bubble, by selectively presenting content deemed most relevant to the user based on their past online behavior, such as clicks, likes, shares, and search history.⁹ The non-transparent nature of these algorithmic choices means users are often unaware of how their information diet is being shaped.⁹ The core problem algorithms are designed to solve is how to increase viewership and keep users engaged, as this directly translates into monetary gain for social media companies.¹³

A significant consequence of this engagement-driven design is the preferential amplification of sensational or polarizing content.¹¹ Algorithms are optimized to identify and promote content that is likely to generate high levels of user interaction, regardless of its veracity or potential for divisiveness.³ This creates a feedback loop where extreme articles, which tend to achieve higher engagement, are more widely disseminated.³ For example, research indicates that articles with extreme political slants are approximately four times more likely to be widely shared on platforms like Facebook compared to less extreme content.³ This pattern suggests that if the objective of social media companies is to maximize engagement, they possess limited incentives to curtail the diffusion of extreme or polarizing articles.³ This systemic preference for engagement over accuracy means that content designed to provoke strong emotional responses might gain wider reach, making users more resistant to opposing perspectives.

This algorithmic amplification directly contributes to the creation of echo chambers. By continuously feeding users content that aligns with their existing beliefs and preferences, algorithms limit exposure to diverse viewpoints, pushing users towards more extreme ideological positions.¹¹ This process can lead to a "fracturing of shared reality," where individuals inhabit increasingly homogenous news feeds, and alternative viewpoints effectively vanish from their view.¹³ The more users engage with content that confirms their biases, the more the algorithms learn to provide similar content, trapping users in a self-reinforcing cycle.²²

The implications extend beyond mere exposure. The attention economy can have an addictive quality, similar to how the brain responds to certain substances, potentially leading to negative side effects such as poor physical health and depression.¹³ Furthermore, personalized content can make users susceptible to "nudges" small suggestions that influence behavior. Studies have shown that platforms can manipulate users' emotional states by curating news feeds, leading to "massive-scale emotional contagion via social networks".¹³ If moods influence behavior and digital content influences moods, then user behavior can be subtly manipulated, blurring the line between persuasion and control.¹³ This highlights a systemic issue where commercial interests conflict with the public good of diverse information exposure and informed decision-making.

Table 2 Psychological and Algorithmic Mechanisms Driving Digital Echo Chamber Formation

Category	Mechanism	Description	Impact on Polarization
Psychological	Homophily	Tendency to seek out and associate with similar others.	Forms ideologically homogenous online groups.
	Confirmation Bias	Tendency to seek, interpret, and remember information that confirms existing beliefs.	Reinforces existing views, increases ideological rigidity.
	Selective Exposure/Retention	Actively choosing aligning information; difficulty remembering conflicting information.	Limits exposure to diverse viewpoints, strengthens existing beliefs.
	Biased Assimilation	Interpreting new information in a way that supports one's own viewpoint.	Overemphasizes supporting evidence, dismisses contradictory evidence.
	Groupthink	Homogenous groups thinking similarly, lacking internal contradiction.	Leads to more extreme beliefs, reduced critical evaluation.
Algorithmic	Attention Economy	Platform business model prioritizing user engagement for revenue.	Incentivizes content that maximizes clicks, likes, shares, time on platform.
	Algorithmic Filtering/Curation	Personalized content delivery based on user data and past behavior.	Creates filter bubbles, limits viewpoint diversity, reinforces existing biases.
	Amplification of Sensational/Polarizing Content	Algorithms favoring content that generates high emotional engagement.	Disproportionately spreads extreme articles, fuels divisiveness.

3. Health emergencies (covid-19)

The COVID-19 pandemic served as an unprecedented global health crisis, simultaneously triggering a parallel "infodemic" an overwhelming flood of information, both accurate and false, that created widespread confusion, mistrust, and hindered public health efforts.²² Social media platforms played a central role in both the dissemination of crucial health information and the amplification of polarizing narratives and misinformation during this period.

3.1. The Infodemic: Misinformation and Disinformation During COVID-19

The term "infodemic" aptly describes the overwhelming volume of information, including false or misleading content, that characterized the COVID-19 pandemic.²² Within this context, misinformation is defined as false or inaccurate information spread regardless of intent to mislead, often colloquially referred to as "fake news".²⁴ This contrasts with disinformation, which is false information deliberately intended to mislead.²⁵ The rapid dissemination capabilities of social media platforms allowed misinformation to spread quickly, often during significant societal events like the pandemic.²⁴

During the early months of the COVID-19 pandemic, a flurry of misleading information proliferated online. Examples included false claims about natural remedies for the virus, such as steam inhalation or ginger.²⁶ Other pervasive false narratives involved inaccurate or completely made-up claims about the origins of COVID-19 and the purported links between 5G technology and the virus.²⁴ The "plandemic" video, which spread widely and contained clearly wrong and harmful information, was a notable instance that social media companies subsequently took down.²⁴

The mechanisms driving this rapid spread are multifaceted. Social media reward systems inadvertently encourage the dissemination of misinformation by constantly reinforcing sharing—any sharing—with likes and comments.²⁶ This system creates "habitual users" who are largely unconcerned with the content they post, prioritizing attention and engagement over accuracy.²⁶ Research indicates that a relatively small proportion of highly habitual users can have an outsized impact on the information ecosystem. For example, a study found that the 15% most habitual Facebook users were responsible for 37% of the false headlines shared in the study, demonstrating that these users would share any type of information, even if it contradicted their political beliefs, simply for the rewards of engagement.²⁶ This highlights that the problem is often systemic, rooted in the platform's reward structure, rather than solely an individual issue.²⁶

The sheer volume and speed at which false news disseminates over social media is notable, often spreading at a greater rate than real news.²⁷ This phenomenon can be influenced by algorithmic tendencies that appear to favor engagement, meaning emotionally charged content, regardless of accuracy, often spreads more rapidly. The resulting 'infodemic' may contribute to public confusion and declining trust, making it more challenging for health organizations to communicate accurate, timely information and manage crises effectively.

3.2. Amplification of Partisan Polarization and Vaccine Hesitancy

The COVID-19 pandemic became deeply politicized, revealing and exacerbating existing partisan divides in public opinion. A significant partisan gap emerged in how people perceived the threat of COVID-19, with Republicans generally expressing less concern about personal risks and the pandemic's seriousness compared to Democrats.²³ This partisan alignment was so strong that it was a far more powerful predictor of Americans' willingness to adopt protective behaviors like staying home and reducing social mobility than the actual number of COVID-19 cases in a region.²³

News media played a complex role in shaping these perceptions. While overall exposure to COVID-19 news tended to "mainstream" or homogenize otherwise divergent risk perceptions between partisans, particularly by increasing the perceived seriousness among Republicans who initially showed less concern, a different dynamic emerged with selective media consumption.²³ Partisan news outlets in the highly polarized U.S. media environment frequently emphasized partisan conflicts and angles, contributing to the politicization of the public health response.²³ Individuals who selectively tuned into like-minded news sources exhibited a wider gap in their COVID-19 risk assessments along party lines, suggesting that actively seeking ideologically congenial news sources is associated with more polarized perceptions.²³ This indicates that while general exposure to the common themes of the pandemic could lead to a more unified understanding, selective exposure within echo chambers reinforced partisan divides.

The politicization of the pandemic directly impacted vaccine hesitancy, a significant barrier to global vaccination campaigns.²⁹ Social media platforms became fertile ground for amplifying the "anti-vaxx" movement, leading to reduced vaccination rates and outbreaks of preventable diseases even before COVID-19.²⁹ During the pandemic, echo chambers on social media were found to promote conspiracy theories about the virus and were linked to vaccine hesitancy, reduced compliance with mask mandates, and less adherence to social distancing guidelines.²² These closed networks

reinforce pre-existing beliefs, making individuals more dependent on internal sources for information and behavioral advice, and actively excluding or discrediting other viewpoints.²²

Research into public perceptions of COVID-19 vaccines on social media, particularly Twitter, identified key themes contributing to vaccine hesitancy up to early 2021: mistrust in vaccine science, the politics of vaccination, and religious pushbacks.²⁹ Mistrust in vaccine science was the most prevalent theme, encompassing general skepticism towards vaccines, concerns about unknown side effects (e.g., infertility, new diseases), and a perceived lack of transparency in vaccine development.²⁹ The politics of vaccination theme reflected a widespread belief that vaccine development and administration were politically motivated, with political party stances influencing acceptance or distrust.²⁹ Finally, religious pushbacks, observed in countries like the U.S. and Brazil, involved religious leaders discouraging vaccine use and followers expressing greater trust in divine intervention over vaccination.²⁹ These qualitative themes underscore how deeply personal beliefs, political affiliations, and religious convictions interacted within social media environments to shape public health outcomes.

3.3. Erosion of Public Trust and Non-Compliance

The amplification of misinformation and the entrenchment of partisan polarization within digital echo chambers during health emergencies have profound consequences, most notably the erosion of public trust and subsequent non-compliance with critical health guidelines. Trust erosion refers to the gradual decline of confidence and belief that stakeholders, including the public, have in an organization or institution, often as a result of negative events, poor communication, or unethical behavior.³² This erosion can occur rapidly during a crisis and may take years to rebuild, underscoring the critical importance of effective crisis management and transparent communication.³²

During the COVID-19 pandemic, misinformation and conspiracy theories contributed significantly to increased fear and anxiety, while simultaneously undermining public trust in credible health experts and organizations.³³ This creates a problematic feedback loop: the mistrust fueled by misinformation enables its continued spread, as people become more inclined to trust alternative sources that discredit legitimate health authorities.³³ Such a decline in trust has direct implications for public adherence to evidence-based health advice, impacting the health of individuals and populations.³³

The politicization of the pandemic, amplified within echo chambers, further compounded this issue. When public health recommendations become politicized, communication efforts are hampered, as different media outlets may downplay or exaggerate the severity of the pandemic based on their ideological biases.³¹ This partisan divide in perceived threat, as discussed, directly influenced individuals' susceptibility to misinformation. People were more likely to believe false claims that confirmed their existing beliefs about the pandemic's seriousness.²³ For instance, those who perceived COVID-19 as highly serious were more susceptible to misinformation exaggerating its dangers, while those who found it less serious were more likely to believe claims downplaying its risks.²³ This confirmation bias, facilitated by echo chambers, meant that individuals were less likely to critically evaluate information that aligned with their pre-existing views, even if it contradicted official health guidelines.

The overall impact of this dynamic on public health was substantial. Misinformation led to widespread confusion, contributing to lower intent to accept COVID-19 vaccines and reduced adherence to official health guidelines, including basic preventive measures.¹⁵ This hesitancy, exacerbated by anti-vaccine propaganda, created significant barriers to achieving herd immunity and prolonged the pandemic's impact.¹⁵ The long-term consequences of such trust erosion include diminished brand reputation for public health institutions, reduced public engagement with health campaigns, and a general decline in societal resilience to future health crises.³² Rebuilding this trust requires consistent positive interactions, transparent communication about corrective actions, and a demonstrated commitment to ethical practices.³²

A significant challenge in academic research is establishing the direct causal effects between social media information, particularly misinformation, and actual health behavior.⁵ Methodological hurdles include the difficulty in linking online activity to offline actions due to data scarcity and privacy concerns, and the complexity of excluding external variables that might influence behavior.⁵ There is also a notable lack of standardized measures for "misinformation" and "health behaviors" across studies, and many studies rely on self-reported data, which may not accurately reflect objective behavior.⁵ Furthermore, studies are often limited geographically, primarily to Western countries, and may suffer from sampling biases, as social media data might not represent the broader population.⁵ These limitations highlight the complex nature of demonstrating a direct causal link, despite strong evidence of correlation between misinformation exposure and changes in knowledge, attitudes, or behavioral intentions.⁵

4. Natural disasters

Social media's role during natural disasters is a dual-edged sword, offering invaluable tools for emergency response while simultaneously acting as a conduit for misinformation and polarization, significantly complicating crisis management.

4.1. Spread of Misinformation and Conspiracy Theories

During natural disasters, social media platforms become crucial for real-time information sharing, but they also become fertile ground for the rapid spread of false information and conspiracy theories.⁶ The urgency and uncertainty inherent in disaster situations create a psychological environment where individuals seek explanations and, sometimes, someone to blame.³⁴ This human tendency can lead to the proliferation of outlandish claims.

A notable example occurred in February 2023, following the major earthquakes in Turkey and Syria. Despite ongoing rescue operations, disinformation rapidly spread on social media claiming that the walls of the Hatay Yarseli Dam had cracked and were about to explode.³⁵ This false report, amplified through platforms, created an aura of panic in the region, directly disrupting critical rescue and aid activities.³⁵ The immediate societal impact was widespread anxiety, with people attempting to flee the city, causing chaos and road closures.³⁵ This incident also highlighted how such panic could be exploited by malicious actors, with law enforcement officers reporting that looters were spreading these false claims to facilitate their criminal activities.³⁵

Another significant case involves the HAARP conspiracy theory, which claims that the High-frequency Active Auroral Research Program can manipulate weather and cause earthquakes. Analysis of Twitter data from January 2022 through March 2023 revealed a direct correlation between high-impact earthquakes and a significant increase in HAARP discussion.³⁴ For instance, the February 6, 2023, Turkey and Syria earthquake led to an all-time high in HAARP-related tweets, with over 150,000 tweets on that single day.³⁴ This surge in discussion was also observed after other significant seismic events.³⁴

The analysis of this phenomenon indicates a clear reinforcement of beliefs within digital echo chambers. Before the February 2023 earthquake, HAARP discussions were diverse, covering general weather manipulation and government involvement.³⁴ However, after the earthquake, keywords shifted directly to the event, with prominent mentions of affected locations and military terms, indicating a transition from general conspiracy theories to specific event-related accusations.³⁴ A positive correlation was found between the number of tweets and the mean sentiment, suggesting that as the discussion intensified, the overall sentiment became more positive.³⁴ This indicates that when individuals who believe in conspiracy theories find others who share their views, it validates their worldview and provides a sense of community, creating an echo chamber effect that solidifies the conspiracy theory and makes it harder for individuals to question their beliefs.³⁴ This can also lead to a sense of empowerment and distrust of authority, further isolating believers from mainstream society.³⁴ While the study notes that correlation does not imply causation, it clearly illustrates how major events act as catalysts for amplifying such theories on social media.³⁴

4.2. Impact on Emergency Response and Public Behavior

The spread of misinformation and the amplification of polarized narratives during natural disasters have tangible, detrimental impacts on emergency response efforts and public behavior. Effective disaster management relies heavily on prompt and accurate information dissemination, situational awareness, and coordinated public response.⁷ When social media becomes a conduit for false information, these critical functions are compromised.

The panic caused by misinformation, as seen in the Hatay Yarseli Dam incident, directly interrupts search and rescue operations. Emergency personnel, diverted by false alarms or facing chaotic public reactions, lose valuable time and energy that could be dedicated to life-saving activities.³⁵ This highlights a critical vulnerability: the digital realm's misinformation can have immediate and severe physical consequences, potentially costing lives.³⁵

Moreover, the politicization of truth, where beliefs about a crisis (e.g., the efficacy of certain interventions or the cause of a disaster) become strongly tied to political persuasion, can significantly impede collective action.¹³ If, for example, a society becomes polarized about the efficacy of a protective measure like mask-wearing during a health crisis, this division can stall decision-making processes and prolong the crisis.¹⁶ This "radical politicization of truth" extends to natural disasters, where conspiracy theories about government weather control or hidden agendas can undermine trust in official warnings and guidance.¹⁴

Challenges for emergency communicators are significant. They must not only provide timely and accurate information but also actively counter a continuous flow of misinformation and conspiracy theories.⁸ The sheer volume of false information can obscure reliable guidance, making it difficult for the public to discern trustworthy sources, especially when individuals are under stress and may be less equipped to critically process information. The need for timely information during disasters also challenges traditional ways of establishing trust, as the speed of social media often outpaces traditional verification processes.³⁸ This underscores the importance for emergency management organizations to enhance their mechanisms for incorporating and verifying user-generated information from social media sources in their disaster response efforts.³⁸

The overall effect is a fragmentation of public understanding and a diminished capacity for unified response. When different groups within society hold stable, mutually exclusive beliefs about a disaster, even with communication channels open, it creates a situation where a shared reality is fractured.¹³ This can lead to a breakdown in cooperation and the pursuit of a common good, challenging the resilience of societies in the face of major shocks.¹⁴

5. Armed Conflicts

Social media platforms have fundamentally altered the dynamics of armed conflicts, transforming into critical battlegrounds for information warfare and the amplification of polarized narratives. This digital dimension profoundly impacts public opinion, international perceptions, and societal cohesion.

5.1. Polarization of Narratives and Ideological Stances

In politically sensitive scenarios like armed conflicts, social media serves as a potent platform for polarized discourse and the expression of strong ideological stances.³⁹ The rise of user-generated content means individuals can act as both producers and consumers of information, leading to rapid and widespread dissemination of narratives that reinforce existing beliefs.⁴ This environment often results in the formation of distinct online communities, or echo chambers, where users primarily interact with opinions supporting their pre-existing beliefs and actively exclude or discredit other viewpoints.¹

The Russia-Ukraine war, which began in February 2022, provides a compelling illustration of this phenomenon, often described as the first "full-blown social media war".⁴¹ Both sides strategically leveraged social media to amplify their narratives, often manipulating algorithms and utilizing bot networks.⁴¹ Key disinformation frames identified in the conflict during 2021-2022 included portraying Donbas as a 'victim,' Ukrainian political elites and nationalism as the 'enemy,' and Ukraine as a symbol of Western aggression against Russia.⁴¹ These frames were designed to shape public opinion and bolster support for specific objectives.

The media discourse surrounding the war in Ukraine in 2022 clearly demonstrated polarization through various discursive strategies.⁴² These strategies constructed a dichotomy of "In-group" versus "Out-group" by:

- **Labelling:** Tagging groups with positive or negative connotations (e.g., Ukrainian army as "formidable, courageous," Russian army as a "disorganized horde of amateurs").⁴²
- **Evidentiality:** Citing public officials and eyewitnesses to instill confidence in views.⁴²
- **Number Game:** Presenting exact data to create an illusion of objectivity, often combined with victimization to highlight casualties.⁴²
- **Hyperbolism:** Magnifying positive impressions of the in-group and negative acts of the out-group (e.g., Ukraine making Russians "pay for every inch of territory").⁴²
- **Victimization:** Presenting the in-group as suffering from the out-group's actions.⁴²
- **Personalization:** Assigning human qualities to non-humans to evoke emotional support (e.g., "Ukraine has taught us all a lesson in moral courage").⁴²
- **Analogy:** Comparing current events to historical ones to create mental models by association (e.g., comparing Russia to Nazi Germany).⁴²

These strategies, often used in combination, served to reinforce existing ideological stances and deepen the partisan divide within and across societies.⁴² The result is that social media users, particularly those with higher political interest, tend to exhibit greater ideological rigidity and resistance to information that challenges their beliefs.¹⁹ This contributes to a broader societal polarization where antagonistic factions impede cooperation and the pursuit of a common good.¹⁴

5.2. Information Warfare and Disinformation Tactics

Information warfare is a critical component of modern conflict, and social media has become its primary battleground. Disinformation, defined as false information deliberately intended to mislead, is weaponized to sow disorder, mistrust, and radicalization, influencing public sentiment and even compelling violence.⁴³

Russia, for instance, has a long history of employing "active measures" and disseminating false narratives and conspiracy theories as a tool of war.⁴¹ Numerous false narratives concerning the Russia-Ukraine war have been debunked, with hundreds of sites identified as supporting these myths.⁴¹ These tactics include the use of internet bots—automated agents that spread a constant flow of biased information—which can significantly increase polarization and misinformation within social networks.¹⁶ Bots can operate in coordinated "botnets" and use tactics like tagging influential accounts to increase exposure and manipulate users into resharing misinformation.³

The objective of such information warfare is to manipulate public opinion by intentionally distributing misleading information.⁴¹ This is achieved through a complex system involving websites, social media, and bots.⁴¹ The influence operations enabled by social media are often more potent than those possible through traditional mass media.⁴¹ The blurring of lines between persuasion and control becomes particularly evident in these contexts, as digital content can influence moods and, consequently, behavior.¹³

Even non-state actors and, notably, the Ukrainian side, have engaged in disinformation strategies during the conflict, such as spreading heroic stories that were later debunked, with the aim of boosting morale and garnering international sympathy.⁴¹ This highlights that disinformation is a pervasive tactic employed by various actors in conflict zones, further complicating the information environment and making it challenging for the public to discern truth from fabrication.

5.3. Challenges of Content Moderation and Societal Division

The scale and speed of information dissemination during armed conflicts present immense challenges for social media platforms regarding content moderation. Platforms struggle to balance policies against hate speech with the justifiable anger and outrage expressed by populations affected by conflict.⁴¹ Standard moderation algorithms often prove insufficient in this complex, emotionally charged situations.⁴¹ For example, reports indicated that updates from the Ukrainian war zone were sometimes flagged as 'sensitive content' or 'shadow-banned' for English-speaking audiences on platforms like Twitter, limiting their reach.⁴¹

The core tension lies between upholding freedom of expression and preventing the spread of harmful content, including incitement to violence, misinformation, and foreign propaganda.⁴ Social media operators are incentivized to prioritize content that increases user engagement and expands their active user base, which can inadvertently lead to the amplification of radical and polarizing content.⁴ This economic model creates a disincentive for platforms to curtail the diffusion of extreme articles, as these often generate higher engagement.³

The consequences of this inadequate moderation extend beyond the digital realm, with online polarization and hate speech having a documented spillover effect on offline violence and protests.¹⁴ Societal polarization, aggravated by fake news campaigns and online hate speech, poses a significant threat to societal harmony, characterized by the fragmentation of society into antagonistic factions with vehemently opposed values and identities.¹⁴ This impedes cooperation and the pursuit of a common good, making it harder for societies to respond cohesively to crises. The global concern over hate speech "super-charged by the internet" highlights its potential to provoke offline violence.¹⁴ While some governments attempt to combat this through censorship and monitoring, such measures themselves can be perceived as threats to free speech and contribute to further polarization.¹⁴ This complex interplay underscores the urgent need for a nuanced approach that balances platform responsibility, user rights, and societal well-being.

6. Discussion

6.1. Interplay of Psychological, Algorithmic, and Societal Factors

The analysis across health emergencies, natural disasters, and armed conflicts reveals a consistent and dangerous interplay among psychological predispositions, algorithmic designs, and societal dynamics in amplifying polarization through digital echo chambers. Human cognitive biases, such as homophily, confirmation bias, and selective exposure, drive individuals to seek out and engage with information that confirms their existing beliefs, naturally forming homogenous social networks.¹ This inherent human tendency is not new, but it is profoundly exacerbated by the architecture of social media platforms.

Platforms, driven by an "attention economy," employ algorithms designed to maximize user engagement by curating personalized content.¹³ These algorithms, by prioritizing content that aligns with a user's preferences and is likely to generate strong emotional responses, inadvertently amplify sensational and polarizing material.³ This creates filter bubbles, where users are passively shielded from diverse viewpoints, and reinforces existing echo chambers, where active discrediting of external sources solidifies insular beliefs.¹ The constant reinforcement of sharing, regardless of content accuracy, creates habitual users who disproportionately spread misinformation.²⁶

This reinforcing cycle between human psychology and technological design leads to a "fracturing of shared reality".¹³ As individuals become increasingly isolated in their ideologically consistent information environments, their views become more extreme, and their capacity for empathy or understanding towards opposing groups diminishes.¹² This societal fragmentation, characterized by stable, mutually exclusive beliefs, is not merely a minor disagreement but a deep division where opposing sides are often viewed as "worse".¹² The critical implication is that the design of social media platforms, while ostensibly connecting people, can inadvertently drive them further apart by exploiting natural human biases for commercial gain.

6.2. Consequences for Collective Action, Public Trust, and Crisis Response

The amplification of polarization through digital echo chambers during emergencies carries severe consequences for collective action, public trust, and the efficacy of crisis response efforts. In health emergencies like COVID-19, this manifested as a politicization of public health measures, leading to widespread vaccine hesitancy, non-compliance with guidelines, and increased fear and anxiety.²² The partisan divide in risk perception, amplified by selective media exposure, directly undermined a unified public health response.²³

During natural disasters, the rapid spread of misinformation and conspiracy theories within echo chambers has tangible, life-threatening impacts. False alarms, such as the Hatay Yarseli Dam incident, directly disrupted critical search and rescue operations, wasting valuable time and resources and potentially costing lives.³⁵ The spread of conspiracy theories, like HAARP, following earthquakes, further erodes public trust in official explanations and scientific understanding, making coordinated public behavior challenging.³⁴

In armed conflicts, social media becomes a tool for information warfare, where disinformation tactics are used to manipulate public opinion, sow mistrust, and even incite violence.⁴¹ The deliberate construction of polarized narratives through discursive strategies like labelling and hyperbolicism deepens societal divisions and hinders any potential for de-escalation or shared understanding.⁴² The challenges of content moderation in these high-stakes environments are immense, as platforms struggle to balance free speech with preventing the spread of harmful content, often leading to a "spillover effect" of online animosity into offline violence.¹⁴

Across all crisis types, the overarching consequence is the undermining of public trust in authoritative institutions—governments, scientific bodies, and emergency responders.³² Once trust is eroded, it is exceptionally difficult and time-consuming to restore.³² This fragility of public trust directly impedes collective action, as a fragmented and distrustful public is less likely to adhere to unified guidance, cooperate with authorities, or engage in behaviors necessary for effective crisis response. The result is a prolonged and exacerbated crisis, with heightened human and societal costs.

6.3. Limitations of Current Research and Future Directions

Despite significant academic attention, research on digital echo chambers, filter bubbles, and polarization faces several inherent limitations, particularly concerning methodology, data access, and generalizability. A major challenge is establishing direct causal effects between social media use, exposure to misinformation, and actual offline behaviors.⁵ This is complicated by data scarcity, privacy concerns, the difficulty of isolating social media's influence from other external variables, and the lack of comprehensive longitudinal data.⁵ Many studies rely on self-reported data, which can be unreliable, and there is a lack of standardized measures and definitions across the field.⁵

Furthermore, much of the existing research is heavily concentrated on the United States, which is often considered an outlier among high-income democracies due to its uniquely polarized political landscape.⁴⁴ This US-centric bias limits the generalizability of findings to other national contexts, where patterns of polarization and media use may differ significantly.⁴⁴ There is a notable dearth of comparative studies and less research specifically on scientific issues compared to political discourse.⁴⁴ Many studies are also limited to a single social media platform, which may overestimate the prevalence and impact of echo chambers, as individuals rarely use only one platform in isolation.⁴⁴

A critical barrier to more comprehensive research is the lack of sufficient and privacy-compliant access to data from social media platform companies.¹⁷ This restricts the ability of academics to conduct large-scale, nuanced analyses of

content dissemination, user behavior, and network dynamics. The "impossibility result" highlighted in some research suggests that a general regulation function to reduce echo chambers while preserving core democratic values like freedom of expression and user privacy may not exist, leaving difficult choices for future policy.¹⁷

Future research should prioritize multidimensional and longitudinal studies that integrate diverse data sources (e.g., social media data with surveys, census data, health records) to better establish causal links and account for sampling biases.⁵ There is also a pressing need for more comparative studies across different national and cultural contexts to understand the varying manifestations of digital echo chambers and polarization.⁴⁴ Finally, greater collaboration between academic researchers, policymakers, and social media companies is essential to facilitate ethical data access and inform the development of effective, evidence-based interventions that promote information diversity and rebuild shared understanding in times of crisis.⁵ This includes exploring transparent algorithmic adjustments and digital literacy programs that empower users to critically evaluate information and seek out diverse perspectives.²⁰

7. Conclusion

Digital echo chambers have emerged as significant amplifiers of polarization during emergencies, undermining collective action, public trust, and the effectiveness of crisis response efforts. Mitigating their impact requires coordinated efforts between platforms, policymakers, and communicators to promote information diversity and rebuild shared understanding in times of crisis.

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