

Echo Chambers and Fragmented Public Opinion in U.S. Social Media Communication

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Abstract: With the spread of algorithm-driven social media platforms, US citizens have learned about politics in a new way, and at the same time, a problem of an echo chamber has emerged that intensifies ideological division and polarizes public discourse. Twelve peer-reviewed journal articles published between 2023 and 2026 have been collected to explore both the empirical and theoretical foundations of the echo chamber hypothesis across the four main platforms: Facebook, X (formerly Twitter), YouTube and TikTok. Rather than viewing algorithmic curation as a single, uniformly polarizing force, this paper breaks down the four interacting mechanisms of algorithmic recommendation, selective exposure and network homophily, cross-platform structural variation, and misinformation diffusion, and examines how they jointly promote the fragmentation of public opinion. Recent field experiments have shown that the algorithmic effects reported in these recent field studies are much weaker and more conditional than those suggested by earlier observational studies; however, research that isolates partisan-animosity content, verified-user prioritization, and acrophilic network ties has found robust, platform-specific contributions to affective polarisation. An integrated feedback mechanism has been introduced, and algorithmic curation, user-level selective behaviour, and engagement-driven platform design are recursively reinforced to produce fragmentation that is neither purely technological nor purely psychological in origin. Finally, the paper proposes countermeasures for platform governance, content-level regulation, and forward-looking longitudinal and cross-platform research designs that can separate these intertwined mechanisms.

Keywords: Echo Chambers; Fragmented Public Opinion; Social Media Communication; Algorithmic Curation; Selective Exposure; Political Polarization

1. Introduction

At present, many American voters obtain political information from all corners of society through social media platforms and learn about political differences and opposing views of different groups online. With this change, scholars and the public have been worried for a long time about how algorithms present information for us; we are surrounded by people with similar views and thus live in an "echo chamber". Although the term has been widely used in both academia and the public sphere recently, some recent scholarly work suggests that the echo chamber hypothesis is often treated as a single idea; in fact, it encompasses several different analytical objects, such as algorithmic filter bubbles, epistemic closure, and deliberate structures of strategic discrediting that are resistant to rectification [1]. This confusion is serious because it cannot determine whether the cause of the division in public opinion is technological, psychological or structural, and thus the design of countermeasures will be flawed.

The actual applications of this problem are relatively large. A large-scale analysis of more than 200 million Facebook users during the 2020 election cycle found that exposure to political news is ideologically segregated, but this segregation is significantly asymmetric: conservative-leaning audiences are exposed to a large amount of politically homogeneous and untrustworthy content compared with their liberal-leaning counterparts [2]. Based on the above analysis, the division in U.S. social media communication cannot be ascribed to the design of platforms or any single reason; rather, it is the result of the interaction between algorithms and the political information environment. At the

same time, a large number of field-experiment studies have begun to challenge the assumption that algorithmic curation is the main cause of polarisation; instead, they suggest that the connection between exposure and attitude change is relatively weak, content-dependent, and platform-specific.

Given the contested and rapidly changing evidence base, the present paper will organise the twelve peer-reviewed journal articles published between 2023 and 2026 to clarify how algorithmic curation, user-level selective behaviour, network structure and misinformation diffusion jointly lead to echo chamber formation and opinion fragmentation in U.S. social media communication. The timing of this research is also appropriate; since much of the previous echo chamber studies have been conducted under different circumstances, namely, changes in ownership and verification policies at X, the significant increase in TikTok as a main stage for political dissemination among young people, and the integration of large language models into recommendation systems, all of which have modified the technical environment for fragmentation. A synthesis limited to a single platform or studies conducted before the aforementioned changes may have already become obsolete by the time of policy or platform design. The paper has the following contents. Section 2 introduces the theoretical system based on the four interconnected mechanisms presented in the literature review. Section 3 introduces the method of selection and coding for the corpus of studies. Section 4 shows an all-encompassing feedback model and presents a comparison of platform-level fragmentation indicators. Section 5 introduces the results of platform governance and directions for follow-up research.

2. Theoretical Framework and Literature Review

2.1 Algorithmic Curation and the Filter Bubble Hypothesis

The traditional filter bubble hypothesis is that recommendation algorithms show users only ideologically consistent content, reduce the scope of perspectives they are exposed to, and thus strengthen polarisation. Recently, field experiments have provided some specific evidence. Ludwig and others conducted parallel experiments in Germany and the United States,

manipulating exposure to ideology-based news recommendations, and found that the resulting shifts in ideological polarisation were small; a balanced recommender reduced affective polarisation among moderate users in the German sample but did not achieve a comparable effect in the more partisan environment of the US, suggesting a possible ceiling effect where polarisation is already too high for algorithmic correction to take place [3]. Complementary naturalistic experiments on YouTube also found that short-term exposure to filter-bubble-style recommendation conditions resulted in little measurable change in political attitudes, a result the authors explicitly state is inconsistent with popular narratives of algorithmic radicalization [4].

The revisionist results do not indicate that algorithmic design is ineffective; instead, they suggest that the reason for the change is due to specific attributes of the promoted content. Piccardi et al. conducted a preregistered field experiment on X during the 2024 U.S. campaign to see whether a language model reranked users' feeds based on the prevalence of antidemocratic attitudes and partisan animosity; both decreasing and increasing exposure to such content produced detectable shifts of more than two points in a hundred-point feeling thermometer measuring affective polarization toward the opposing party, and there was no significant asymmetry between the two parties [5]. Therefore, the source of polarisation is not solely ideological conformity but also emotional reasons related to the affective mode and animosity content of algorithmic recommendations. Ferraz de Arruda and others have conducted relevant modelling studies to examine how platforms' weighting of verified users—a Design choice X made after modifying its verification system—affects the development of echo chambers; they found that emphasising extreme verified users increases polarisation, but giving more weight to centrist verified users can reduce it [6]. In short, the above studies show that the effect of algorithms on fragmentation depends on particular design choices and content features, and it is not an all-too-obvious result of personalised recommendation systems themselves [3-6].

2.2 Selective Exposure, Homophily, and Acrophily

A second mechanism is to select a user and

network from a list rather than by algorithm. Zhu and others distinguish between selective exposure, where users proactively seek out attitude-congruent content, and incidental exposure; that is, users come across cross-cutting content without intentional selection. Based on panel data from the 2016 and 2020 U.S. presidential elections, they have found that pro-attitudinal selective exposure is positively correlated with an increase in anger toward political opponents and an increase in enthusiasm for one's own coalition; thus, the pattern of exposure directly affects the affective level of political polarisation [7]. Zimmerman and others have expanded on this behaviour with a behavioural account, showing that network ties on social media are not only shaped by homophily (the tendency to connect with similar people), but also by a different mechanism they refer to as acrophily: an attraction to users who hold more extreme versions of one's own political views. Based on both survey-experimental data and a retweet network of about 3.9 million nodes, the authors have found that acrophily is more pronounced among conservative users and is associated with increased hostility toward political out-groups [8]. This acrophilic dynamic provides a feasible micro-level explanation for the asymmetric segregation pattern reported at the platform level by González-Bailón et al.; that is to say, their Facebook analysis found that politically extreme and untrustworthy content was concentrated in a homogeneous conservative segment of the network [2]. Read together, these studies suggest that selective and acquisitive user behaviour are compounded, and may partially precede algorithmic curation effects, thereby complicating any attribution of the root cause of fragmentation solely to platform design.

2.3 Cross-Platform Structural Variation

Given that the structure and algorithms of echo chambers differ across platforms, studies conducted on a single platform may not be generalizable to others and are therefore not universal. Li and his colleagues analyzed more than 160,000 public TikTok accounts and over 16 million videos posted from 2019 to 2023 to identify separate politically homogeneous clusters on the platform, and found that right-wing communities were more internally consistent and further removed from the main news channels than left-wing communities; this

trend is the same as the asynchronous division seen on Facebook, although the two sites have drastically different algorithms and content types [9]. Avallé et al. have broadened the cross-platform perspective by analysing interaction patterns on eight major platforms, such as Facebook, Twitter, Reddit, Gab and Voat, over the past 34 years and approximately 500 million comments; they found that toxic and conflictual conversational behaviour has remained consistent across all these platforms, topics and time periods, regardless of individual platform design or moderation policies [10]. Therefore, the reasons for the fragmentation of online group interaction may be more closely related to persistent structures in this area than to specific platform algorithms. At the same time, not all the evidence indicates an unavoidable division. Hampton and Cotter have studied how people use social media during major life-cycle changes, such as moving to university, and found that in some cases, social media can expand the diversity of their social networks and thus increase social tolerance; that is to say, offline network changes may disrupt echo chamber effects rather than strengthen them [11]. As shown in the above experiment, this algorithmically determined fragmentation counterexample is necessary; furthermore, it demonstrates that offline social structure can affect online opinion dynamics, and thus, a new pattern has been established: in combination with previous findings of persistence, structural mechanisms can lead to both reinforcement and disruption depending on the specific circumstances [9-11].

2.4 Misinformation Diffusion and the Erosion of Shared Reality

The last is a way that misinformation spreads within and reinforces existing echo chambers, thus increasing the damage to the foundation of shared facts for public discourse. Diaz Ruiz and Nilsson put forward a two-stage model that separates the seeding of disinformation via identity-based controversies from its subsequent spread, and believe that disinformation linked to group identity is rhetorically immune to fact-checking because correcting it is perceived by adherents as an assault on their identity rather than as an impartial rectification of facts [12]. This identity-based account helps explain why the asymmetric concentration of untrustworthy content presented by González-Bailón et al. in a

homogeneously conservative network segment is not simply due to different levels of exposure but rather a self-perpetuating rhetorical dynamic in which misinformation, once spread among an identity-congruent group, spreads with less resistance [2]. In combination with the algorithmic and network-structural mechanisms mentioned above, this indicates that misinformation diffusion does not act as an independent cause of fragmentation but rather as a process that is amplified by and further entrenches the segregated network structure and content-amplification dynamics that have already been discussed.

3. Methodology

Organise the integrated literature synthesis of this study without collecting new primary data. The corpus consists of twelve peer-reviewed journal articles published between 2023 and 2026 in indexed venues such as Science, Nature, the Proceedings of the National Academy of Sciences and PNAS Nexus, New Media & Society, Information, Communication & Society, the Journal of Public Policy & Marketing, and iScience, as listed in Table 1. The selection criteria for the articles were as follows: They had been published in peer-reviewed journals, explicitly discussed the theory or practice of echo chambers, analysed selective exposure, algorithmic curation, fragmentation of public opinion, and were relevant to the U.S. context of social media communication, either through U.S.-based data or by applying generalizable theoretical frameworks validated in cross-

cultural comparisons. Exclude conference papers, preprints, book chapters, and theses/dissertations. Each article was coded according to the four thematic dimensions of the subsections in Section 2: algorithmic curation and filter bubbles, selective exposure and network affiliation, cross-platform structural variation, and misinformation diffusion. Based on an initial reading of the entire corpus, this coding scheme was developed inductively to identify convergent and divergent results from studies that address related theoretical questions using different platforms, samples and methods, as shown in Table 1. To facilitate comparison across platforms, the coded results were further organised into a qualitative cross-platform comparison, presented in Table 2 and illustrated in Figure 1; these comparative ratings represent an interpretative synthesis of the reported directional findings in the studies and are not direct statistics taken from any single source, as explicitly noted here to maintain the traceability of the claims to their original empirical foundations.

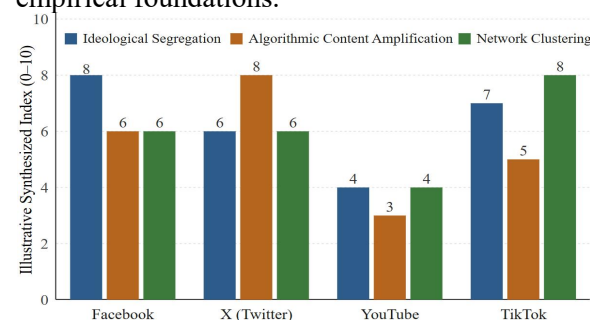


Figure 1. Comparative Synthesis of Echo Chamber Indicators across the Four Major U.S. Social Media Platforms

Table 1. Overview of Reviewed Empirical Studies on Echo Chambers and Fragmented Public Opinion

No.	Study (Author, Year)	Journal	Platform/Context	Method	Primary Focus
1	Diaz Ruiz (2026)	New Media & Society	Cross-platform (conceptual)	Conceptual analysis	Definitional distinctions among echo chamber constructs
2	González-Bailón et al. (2023)	Science	Facebook	Large-scale observational (N ≈ 208 million)	Asymmetric ideological segregation in news exposure
3	Ludwig et al. (2025)	Information, Communication & Society	News recommender (Germany/U.S.)	Field experiment	Causal test of ideology-based filter-bubble effects
4	Liu et al. (2025)	PNAS	YouTube	Naturalistic experiment (N ≈ 9,000)	Short-term effects of filter-bubble recommendations
5	Piccardi et al. (2025)	Science	X (Twitter)	Preregistered field experiment (N = 1,256)	Reranking partisan-animosity content
6	Ferraz de	iScience	X (agent-based)	Computational	Verified-user prioritization

	Arruda et al. (2024)		model)	modeling	and polarization
7	Zhu et al. (2024)	New Media & Society	Cross-platform (election panel)	Two-wave panel survey	Selective vs. incidental exposure and affective polarization
8	Zimmerman et al. (2024)	PNAS Nexus	Twitter/X	Survey experiment + network analysis (≈3.9M ties)	Homophily and acrophily in network ties
9	Li et al. (2025)	New Media & Society	TikTok	Network analysis (160K accounts; 16M videos)	Political echo-chamber clustering
10	Avalle et al. (2024)	Nature	8 platforms	Large-scale comparative analysis (≈ 500M comments)	Persistence of toxic interaction patterns
11	Hampton & Cotter (2025)	Information, Communicati on & Society	Cross-platform (panel)	Survey/panel analysis	Network diversity and social tolerance
12	Diaz Ruiz & Nilsson (2023)	Journal of Public Policy & Marketing	YouTube	Qualitative case study	Disinformation seeding and circulation

Table 2. Synthesized Cross-Platform Comparison of Echo Chamber Indicators

Platform	Dominant Mechanism(s)	Relative Ideological Segregation	Algorithmic vs. User-Driven Weight	Key Source(s)
Facebook	Asymmetric exposure segregation; misinformation concentration	High (asymmetric, conservative-skewed)	Mixed (algorithmic + user-driven)	[2]
X (Twitter)	Content-animosity amplification; verified-user prioritization; acrophily	Moderate-to-high (content-dependent)	Algorithmic (content-specific)	[5,6,8]
YouTube	Recommendation-driven exposure	Low-to-moderate (limited short-term effect)	Weak short-term algorithmic effect	[4]
TikTok	Network clustering; ideological cohesion	High (cluster-based)	User-driven / structural	[9]

4. Findings and Discussion

4.1 An Integrated Feedback Model of Fragmentation

In short, the existing research has not yet identified a single cause for the formation of echo chambers. On the other hand, the evidence supports an integrated feedback model in which algorithmic curation, user-level selection and apathetic behaviour, and platform-specific structural features operate recursively rather than independently, as shown in Figure 2. The algorithmic system first determines the pool of content for the user, and based on this exposure, the user selectively engages with it; at the same time, according to the acrophily mechanism, attitude-congruent and more extreme content are favoured, and these engagement signals are then fed back into the algorithm to further amplify similar content in a recursive loop. Layered on top of this loop is a parallel network-formation

process in which homophilous and acrophilic tie formation produces structurally segregated communities, and within these communities, misinformation, once seeded by identity-driven controversy, circulates with reduced friction and resistance to correction. Affective polarisation, as shown by changes in feelings and thermometers for out-groups, is a result of the above two processes combined, not a direct and unmediated effect of either mechanism alone. The model can reconcile the seemingly contradictory results of the studies reviewed in Section 2: studies that find a minimal effect of ideological filter bubbles per se are not in conflict with studies that find a strong effect of partisan-animosity content or verified-user prioritization, because the model specifically locates polarizing influence in the content and network-affiliation properties that algorithms amplify, rather than in algorithmic personalization as an undifferentiated category. Another effect of this model is methodological:

due to the recursive nature of the feedback loop over a long period, a single-wave or short-term experiment, although well-identified, may systematically underestimate cumulative fragmentation because it fails to capture the long-term effect of any single intervention point. This can help reconcile the relatively small effects reported in brief naturalistic experiments with the large-scale segregation patterns observed over the long run, as the two designs are, in fact, measuring different temporal sections of the same recursive process and do not yield genuinely contradictory estimates of a single fixed effect.

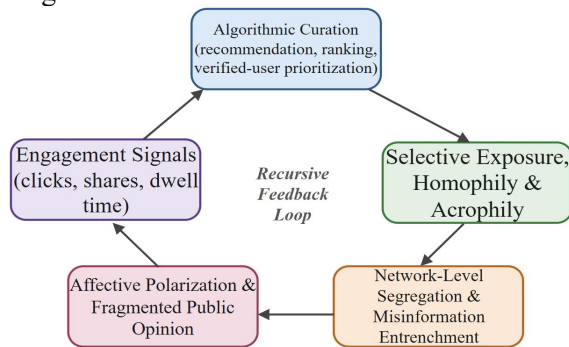


Figure 2. Integrated Feedback Model of Echo Chamber Formation in U.S. Social Media Communication

4.2 Cross-Platform Comparison

Synthesizing the platform-specific findings reviewed in Section 2.3 shows that there is substantial variation in how the above mechanisms are realised across the main U.S. social media platforms, as shown in Table 2 and Figure 1. Facebook has shown strong evidence of asymmetric ideological segregation due to algorithmic curation and a conservative-skewed concentration of untrustworthy content, and as one of the most studied platforms in this field, it is frequently mentioned in relevant literature. X shows particularly strong evidence for the role of content-specific amplification, given the demonstrated causal effect of partisan-animosity reranking and the polarizing outcomes of elevating extreme verified accounts. YouTube, on the other hand, showed relatively weaker short-term algorithmic effects in the controlled experiment and thus its recommendation-driven fragmentation concerns may be more relevant to long-term or qualitatively different usage patterns than those observed in existing naturalistic experiments. TikTok shows prominent network-structural segregation, and right-wing communities are particularly

cohesive and isolated clusters despite the platform's relatively short history compared with others. The above cross-platform variations show that fragmentation should not be viewed as a uniform feature of social media in the abstract; instead, the relative weights of algorithmic, behavioural, and structural mechanisms differ significantly among the various platforms according to their own design, types of content and user bases, and it has also been found that toxic and conflictual interaction patterns occur on all kinds of platforms despite these design differences.

4.3 Implications for Governance and Intervention

The above results directly inform the management of the platform and provide a basis for designing countermeasures to the problem of dispersed public opinion. Given that the evidence indicates that content-level features, such as partisan animosity and the prominence of extreme verified accounts, have a stronger and more readily demonstrated polarizing effect than ideological filtering in itself, interventions targeting the amplification of identity-based animosity content may be more feasible and effective; otherwise, general efforts to diversify algorithmic exposure have shown limited results in recent field experiments after polarisation has significantly hardened. At the same time, Hampton and Cotter's proposed disruptive potential of the offline network diversification does not suggest limiting intervention to platform algorithm adjustment; rather, policies and design features promoting the formation of cross-cutting personal ties, either through life-course transitions or platform features that enable connection across ideological divides, may offer another path to reducing fragmentation [11]. Finally, given that it has been shown that the spread of misinformation is driven by identity-protective rhetorical dynamics and not by a lack of information, media literacy interventions will be more effective if they target the identity-protective function of belief in misinformation rather than concentrating solely on fact-checking.

5. Conclusion

Based on the latest peer-reviewed studies, this paper will examine the reasons for the formation of echo chambers and the division of public opinion on U.S. social media. Based on the

evidence reviewed, fragmentation is best understood as the result of a recursive feedback mechanism that does not directly stem from algorithmic ideological filtering but rather arises from the interaction and reinforcement of algorithmic curation, user-level selection and aphobic behaviour, platform-specific structural characteristics, and identity-driven dissemination of misinformation over an extended period. Theoretically, this reorientation does not consider the algorithm as an autonomous cause and, instead, focuses on the content and network-affiliation traits that the algorithm enhances; practically, it proposes that interventions targeting content-level hostility and offline network diversity may be more feasible than broad diversification requirements for algorithms. The current synthesis is subject to the limitations of its literature-based approach: it is based on twelve studies concentrated in the U.S. and Western Europe, cannot replace primary longitudinal or experimental data, and given the rapid changes in the design of major platforms, findings associated with specific algorithm configurations may have a short shelf life. In the future, longitudinal, cross-platform, and causally identified designs will be used in subsequent research to further dissect the relative weights of these interconnected mechanisms and to examine how long-lasting the effects of the proposed interventions are in the changing environment of platforms and their user bases. For scholars of communication and media policy, the most immediate contribution of this synthesis is conceptual: it provides a system for formulating specific questions about fragmentation, replacing the general question of whether social media causes echo chambers with the more feasible question of which combination of algorithmic, behavioural and structural factors, on which platform, leads to measurable fragmentation among certain groups in the public. Further research will probably be carried out to form a more precise research plan and, in turn, strengthen the scientific consensus and provide practical references for platform designers and regulators in response to the fragmentation of American public opinion.

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