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# Role of Echo Chambers in the Polarization of Society

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*The process of digitization gives easy access to online communication. This evolution should, in theory, make political processes more democratic and increase political accountability since social networks provide instant contact with politicians and provide for accountability. Yet digitalization has also introduced new threats for democracy, with the advent of fake news, online bot networks, artificial intelligence (AI), and social media algorithms. These developments are linked to a rise of far-right parties in Europe and around the world in recent years. Populism and extremism can thrive in the digital ecosystem because the relative costs of reaching a mass audience on social networks to spread their messages are low, and it is an efficient way of reaching out to potential supporters. This article examines how echo chambers form and function on social media platforms and how they are connected to driving societal polarization. The analysis is based on desk research and critical inquiry through the lenses of echo chambers, polarization, and the logic of virtual communication. The first aim of the article is to study how social media allows echo chambers to form and how online spaces are exploited by political actors. The second goal is to observe patterns of social polarization and explore how echo chambers are connected to this process.*

**Keywords:** *Digitalization, virtual communication, social media algorithms, echo chambers, polarization, confirmation bias, selective exposure, homophily*

## Introduction

According to Manuel Castells in his book 'The Rise of the Network Society', the most significant feature of this age is digitization (Castells 2010). It decouples communication from space, and thereby lowers the cost of transmitting information to almost zero. It enables widespread participation in socio-political and economic life, fostering greater civic engagement (Prodanov 2012). This can lead to rediscovering the theory of a perfect Habermas' public sphere as a homogenous area where people argue, hesitate and challenge each other and thus - establish public opinion on important lockups. This is when access is a principal tenant of the public sphere. The public sphere in the modern world is homogenous in the sense that everyone has access to it, in theory, through digitalization.

By making the provision and creation of information one-sided, criticism becomes increasingly high, and agency becomes increasingly critical with digitalization. In fact, this democratization of the digital public sphere is hindered by other factors such as digital inequality, disinformation, fake news, and social networks algorithms. There is a risk of fragmentation of the public space, in the prospect of individualization or division and to the spotlight of the self-dependent individual and construction of

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small, isolated groups that much outside of the equality and openness (Krasteva 2014). An increase of like-minded communities is in play with self-organizing people based on similar attitudes, beliefs, and interests. The newly formed social communities encourage the formation and development of new attitudes, of the imposition of public opinion, including the creation of social processes and new models of behaviour in the society (Varbanova-Dencheva 2018).

All this fragmentation of the digital society may seem to be a necessary condition for enhancing identity polarization of public opinion at local and global scale. Polarization as the global trend is shaping, among others, political processes and changes. Social media are another global trend. According to data up to October 2023, almost 64% of the global population are on social media (Datereportal 2024) and when we account for children, elderly citizens and people with limited access to the Internet, then it would mean that most of the adult population use some form of social media. This article explores the relationship between social media penetration and the spread of polarization, analyzing how virtual communication fosters ideological silos. One key analysis by Boxell, Gentzkow, and Shapiro (2017) examined American National Election Studies (ANES) data from 1996 to 2012. They found that political polarization in the United States was much stronger among older generations, who tend to use less social media, than younger ones. This implies that other factors than social media might be driving polarisation more than social media is. In contrast, Lelkes, Sood, and Iyengar (2017) found that access to broadband internet, which enables the use of social media, was related to greater affective polarization—the degree to which individuals feel worse about political opponents. This also means that internet access — and therefore social media — may lead to increased political polarization. These findings reveal mixed implications about the potential effects of social media on political polarization; that social media does play a part in political polarization, but it is not the sole cause of political polarization in its simplest form, but a more complex phenomenon which varies depending on individual demographics or contexts. The purpose of this article is to review the subtle connections between echo chambers, polarization, virtual communication and social media algorithms in a complete synthesis of previous studies. The first goal is to determine whether there is a linear link between echo chambers and polarization, or there is a margin which is more nuanced and mutually enforced. The second goal is to understand how the algorithms of social media affect this bond and establish a pattern. The results contradict various ideas, showing an interactive loop between these factors. A desk analysis approach is used to identify peer-reviewed journal articles, credible reports from well-known institutions and academic books, based on the article's objectives. Literature is aggregated using transparent platforms such as Google Scholar. The research establishes definitions for key concepts (including algorithmic mechanisms, metrics of user engagement, and measures of polarization) and contrasts divergences and convergences across studies, illuminating both unique, study-by-study insights and general conclusions that might be drawn. Similarly, the agreement of results across multiple studies increases confidence in the evidence of repeatedly seen aspects of algorithmic behavior and its impact on communication. The article ends with implications and further research thoughts since the discussed topic lies within the scope of the adjustment of the new age urges

with a pertinent void on the knowledge expansion about networked circumstances in regards to interest and the associated partition.

## Literature Review

### *Echo Chambers*

#### Theoretical Perspectives

"Echo chambers" emerge from media studies and communication theory, gaining traction with the advent of digital media and social networks. Sunstein is one of the first authors to write about this. He examined how people can find themselves living in ideologically homogeneous enclaves, especially on the internet, which he said could contribute to greater polarization. Sunstein referred to these closed-off places as echo chambers in which an individual's own views were enlarged and reinforced by the lack of exposure to dissenting views. (Sunstein 2001). The problem of media echo chambers, specifically in connection to partisan environments, producing greater levels of ideological alignment through limited exposure to opposing viewpoints were addressed by Jamieson and Cappella (2008). According to Levy and Razin (2019), echo chambers are metaphorical rooms (like acoustic echo chambers) in which sounds, or views, reverberate and become magnified in empty spaces. Nguyen takes this further by stating echo chambers are intentionally oppressive social epistemic structures that shut out and discredit other pertinent voices from the conversation to amplify community agreement, yet engender distrust of outsiders (Nguyen 2018). Nguyen's even further distinction between "epistemic bubbles" and "echo chambers" makes the point that whereas the first emerges due to the arrangement of flows of information in space, the second is predicated on an active management of trust to isolate the group from opposing perspectives. Most researchers share an understanding of echo chambers as environments in which individuals only interact with information and opinions that differ little from their own, resulting in limited exposure to outside views, while emphasizing different theoretical mechanisms that can result to the creation and solidification of echoed beliefs and opinions.

#### Mechanisms of Formation

Echo chambers are a digital ecosystem of permeance and interconnectivity where naturalistic tendencies are simultaneously enabled and exploited and so that organic human characteristics interplay with the ways of thinking. These leads to emphasis on three basic mechanisms for the formation of echo chambers.

Homophily is one of the premises to echo chambers formation. It is an individual's disposition to establish contact with like-minded people, to steer away from conflict and cognitive dissonance that occur when faced with contradictory beliefs, and their preference to consume ideologically similar references, in a strong need to be reaffirmed in their thinking (Terren & Borge 2021). In the digital arena, users tend to engage predominantly with like-minded individuals, avoiding exposure to opposing views, a behavior that social media algorithms reinforce. Echo chambers

are a result of citizens leaning on their natural homophobic behaviour. Homophily is prevalent on social media, where algorithms amplify connections among users with shared preferences. Barbera showed that on Twitter homophily produces clusters of ideologically similar people, reinforcing preexisting beliefs (Barbera 2014). This sort of digital homophily is compounded by recommendation algorithms that surface content based on prior user engagement, leading to "filter bubbles" that restrict exposure to opposing perspectives (Pariser 2011).

Selective exposure, the tendency to seek information that aligns with pre-existing beliefs, is a long-standing psychological phenomenon. Meanwhile, selective exposure has been extensively studied regarding consumption of news media, with evidence that people seek out media with compatible political dispositions, strengthening existing views (Garrett 2009, Stroud 2008).

The third prerequisite that leads to the formation of echo chambers is confirmation bias. This is a cognitive bias, where people seek out, interpret, and filter information that confirms what they already believe or what they want to be true (Nickerson 1998). Instead of looking for objective truth, people with confirmation bias are more likely to look for something to prop up what they think and ignore the information that goes against it. Specificity of confirmation bias with regards to political beliefs was initially explored by Taber and Lodge (2002) who found that people process information selectively and that they prefer evidence consistent with their ideologically based beliefs and are thus strongly biased against arguments that contradict their beliefs in a way that over time, the confirmation of their beliefs becomes stronger.

Manifestation of Echo Chambers

Echo chambers are not abstract phenomena but are embedded in concrete online structures that foster ideologically homogeneous discourse. Various digital formats—such as comment sections, private Facebook groups, Reddit subreddits, closed WhatsApp communities, and YouTube comment threads—serve as fertile ground for the formation and maintenance of echo chambers. These spaces are shaped by both user behaviors and platform-specific design features that reinforce selective exposure and confirmation bias.

Comment sections on news websites and social media platforms frequently function as echo chambers, especially when content is polarizing or politically charged. Research by Anderson et al. (2021) demonstrates that users tend to upvote and reply to comments that align with their own political views, reinforcing dominant narratives and marginalizing dissent. This was exemplified during the COVID-19 pandemic on major news portals, where pro- or anti-vaccine sentiments often dominated the discourse in insulated comment threads (Cinelli et al. 2021).

Private Facebook groups are among the most potent echo chamber environments due to their combination of selective membership and algorithmic content curation. Studies have shown that politically oriented Facebook groups, especially those formed around a shared ideology or candidate, systematically filter content to align with the prevailing group sentiment. Ribeiro et al. (2021) provide empirical evidence that during the 2020 U.S. elections, pro-Trump groups functioned as self-contained ecosystems where dissent was moderated out, and conspiracy narratives were

frequently recycled. Similarly, in Eastern Europe, nationalist Facebook communities displayed high degrees of insularity and rejection of mainstream narratives, contributing to populist mobilization (Mihaylova & Todorov 2023).

Reddit subreddits offer another structured case of topical echo chambers. While Reddit's platform design promotes thematic organization, it also facilitates ideological homogeneity within specific subreddits. Research by Weninger et al. (2022) revealed that subreddits show significantly divergent content flows with limited cross-subreddit interaction, even on the same events.

Encrypted messaging apps such as WhatsApp and Telegram also enable the development of tightly knit echo chambers, particularly in politically volatile contexts. Because these platforms offer end-to-end encryption and group size flexibility, they are often used for unmoderated political organizing and message dissemination (Arora & Ghosh 2022).

YouTube's recommendation system has also been criticized for fostering ideological silos. While YouTube has attempted algorithmic reforms in recent years, studies still find that emotionally provocative or politically extreme videos were more likely to be recommended to users already engaging with such content (Ledwich & Zaitsev 2023). Comment sections under these videos further reinforced homogeneity, as dissenting opinions were often downvoted or aggressively countered by community members, creating a hostile environment for ideological diversity.

Echo chambers are not confined to one type of platform but are pervasive across various digital formats, each contributing in structurally unique ways to the phenomenon of ideological insulation.

## The Role of Algorithms in Social Media

Social media algorithms display material according to user preferences, historical interactions, and behaviors. According to Terren and Borge-Bravo, there are two primary layers of echo chambers: exposure to content that aligns with one's beliefs and encounters with like-minded people (Terren & Borge-Bravo 2021). In their systematic literature analysis on social media echo chambers, they categorize these fields into several levels and consider this to be a significant aspect of echo chamber dynamics. Users engage in conversations with people who share their opinions after initially being exposed to content that supports those beliefs (a phenomenon known as the "filter bubble"), which further solidifies those beliefs (Cinelli et al. 2021).

Pariser elaborates on the concept of the "filter bubble," pointing out that social media algorithms are based on user preferences and constantly present content that supports their views and opinions, resulting in echo chambers that conceal opposing viewpoints (Pariser 2011).

The mechanisms of echo chamber formation explain how people try to interact with like-minded individuals, choose to be exposed to information that supports their beliefs, and interpret that information in a way that strengthens and fortifies the echo against opposing viewpoints. Personalized algorithms leverage factors like homophily and minimize the possibility of users coming across opposing views, reinforcing the selective exposure of users to ideologically congruent content.

Although researchers acknowledge and study the role of social media algorithms on echo chambers, a deeper understanding of its mechanisms and effects is needed to grasp the dynamics between echo chambers and polarization in digital environment.

## *Polarization*

### Theoretical Perspectives

A common understanding of polarization is it is the process by which opinions, convictions, or attitudes within a group become more extreme, focusing on opposite ends of a spectrum and reducing ideological diversity. DiMaggio, Evans, and Bryson characterize polarization as a move toward ideological poles when opinions are concentrated on extremes with minimal overlap (DiMaggio et al. 1996). Hetherington concurs, pointing out that polarization produces distinct, diametrically opposed groupings with little opportunity for ideological accommodation (Hetherington 2009). Similarly, partisanship widens the ideological divides between parties or groups, which is how Barber and McCarty define polarization (Barber & McCarty 2015).

An alternative view of Morris Fiorina and Samuel Abrams is that polarization does not always equal extremism; in fact, it is explained by a greater alignment of individuals' issue positions with their partisan identities. This phenomenon is known as partizan sorting where people are more likely to hold consistent opinions that align with their chosen party rather than adopt extreme views across the board (Fiorina & Abrams 2008). This distinction is important because it counters the idea that all polarization leads to radicalization and allows for an ideological cohesion in parties without radicalism. A theoretical gap emerges here in understanding whether polarization inherently involves extremity or whether it can occur simply through ideological sorting. This matters for policy implications because addressing extremism in an election and consistent partisan alignment may call for different strategies. For the purpose of the article, in terms of digital content communication and echo chambers polarization can be defined as partisan ideologies oriented, as often it emerges and deepens around a specific topic argued by a party or even created by a party.

### Causes of Polarization

The growth of digital media, combined with the division of informational sources, has enabled people to choose information that corresponds with their own views. Platforms such as Facebook and Twitter use algorithms to further reinforce this phenomenon by amplifying content which people are similarly likely to agree with inside the filter bubble (Pariser 2011), and shutting them off from opposing viewpoints. According to Bright, the cause of online ideological clustering is simply the nature of homophily (Bright 2017). This is due to selective exposure, which is when people seek out confirmatory information, amplifying echo chambers even more. Such dynamics preclude cross-group interactions, hardening in-group identities and promoting ideological siloing. McCarty, Poole, and Rosenthal trace polarization back to economic inequality, suggesting that increasing inequality increases partisan divides (McCarty et al. 2006). The same can be stated for economic interests, with

the wealthy favouring one set of policies and everyone else favouring something more progressive. Elections with high stakes also drive polarization. McCarty, Poole and Rosenthal claim that party polarization becomes more severe when each party is closely matched in terms of electoral strength (McCarty et al. 2006). It can create a strategic incentive for parties to obstruct opposing parties in such cases. Fiorina delves into how electoral competition make parties engage in divisive tactics (Fiorina 2009). When parties are faced with the need of political victory, they tend to focus on mobilizing their base through polarizing strategies, reducing the incentives for compromise and cooperation across party lines. This competition contributes to a fractious political landscape in which both parties are interested in blocking the other party, each interested in maintaining or increasing its own electoral advantage. This position is reinforced by Hacker and Pierson arguing that narrow electoral contests are a source of a polarized polity (Hacker & Pierson 2010).

## Virtual Communication and Echo Chambers and Polarization

Virtual communication is the exchange of information through digital platforms without physical interaction between participants. According to Mavrodieva (2014), it introduces new ways of interacting and being in relation to one another for individuals and groups, using elements of multimodality, both verbal and visual in virtual space such as social networks, blogs and forums. Compared to traditional forms of communication, virtual communication facilitates spontaneous and asynchronous communication to allow for higher levels of public participation and accessibility (Walther 1996, Mavrodieva 2014). In Bulgaria, for instance, virtual communication has provided a platform for both citizens and politicians to engage in a much more dynamic and accessible process. Social media are used for mobilization and civil demands— as an early form of digital activism (Mavrodieva 2014). It is characterized by independence from physical space, low transmission cost and wider participation through digital citizenship that plays an active role in political and social discourse (Castells 2010, Prodanov 2012).

Digital platforms can accommodate interactions ranging from one-on-one conversations to large-scale public discussions, creating spaces for mass collaboration or segmented interactions depending on the context. With different types of virtual communication formats – text, audio, video, interactive tools – the richness of interaction and engagement (Castells 2010) is enhanced. Combining text and graphics and interactivity engages people. Such multimodality enables them to both consume and produce content in the manner most suited to their interests. Virtual communication, on the other hand, is frequently mediated by algorithms which determine what content and interactions the user is shown. Content shown to users is filtered using algorithms that consider what users have viewed, engaged with, and avoided previously (Bakshy et al. 2015). Digital platforms often provide people with a preference of the extent to which they want to expose themselves, influencing the context and nature of communication (Kondratova & Goldfarb 2005). This option can encourage open expression but also increase the risk of spreading misinformation or hostile behaviors as people have the psychological shield of anonymity.

Algorithms of social media shape the flow of information, including constructing the experience of the user and creating 'filter bubbles' and echo chambers (Kondratova & Goldfarb 2005). Virtual communication environments where users are presented with predominantly similar views and opinions to their own which causes their pre-existing beliefs to be re-enforced are termed echo chambers. These environments are influenced by social media platforms and algorithms. Platforms such as Facebook, YouTube and Twitter operate via algorithms that recommend posts based on user interaction. Such personalization also limits exposure to contrastive perspectives, leading to homogenous informational echo chambers (Nguyen 2018, Bakshy et al. 2015). Users like to search for and see messages that fit their beliefs, thus strengthening boundaries of ideologies (Colleoni et al. 2014).

Virtual communication is presumed to escalate polarization: it allows releasing extreme views faster. Many times, online discussions deepen the gaps between groups of people, since users gravitate around communities that are consistent with their opinions (Terren & Borge-Bravo 2021, Quattrociocchi et al. 2016). Virtual communication makes easier content production and dissemination and facilitates the spread of misinformation confirmed within echo chambers. This causes confirmation of unverified information that supports their narratives to be reinforced with more conviction by polarized groups (Del Vicario et al. 2016).

Digital platforms prioritize emotionally resonant content, which is shared and engaged with more. This amplification of the emotional salience of the group strengthens the in-group beliefs and contributes to greater division between ideologies (Sunstein 2017).

Virtual communication has simultaneously democratized access to information while creating new issues of polarization and misinformation. Studies examining new media and identity show that the growing popularity of virtual communication is changing how people engage in society, especially among younger populations. These changes demonstrate the potential for increased engagement as well as the dangers of polarization and disinformation (Kondratova & Goldfarb 2005).

## Methodology

This research seeks to understand the relationship between echo chambers, polarization virtual communication and social media algorithms. To achieve these objectives, a descriptive and analytical desk research methodology is employed, emphasizing the synthesis of existing literature, reports, and secondary data. This approach has been chosen to comprehensively analyze the subject and identify nuanced relationships between these phenomena.

The desk research method consists of a systematic review and analysis of scholarly articles, case studies, and technical reports. It enables the research to study similarities in the relationship between echo chambers, polarization, and virtual communication across fields; to define the patterns and have a better understanding of the way that social media algorithms operate in either increasing polarization or decreasing it; to summarize conclusions from various contexts and disciplines

synthesising findings across multiple contexts and disciplines to offer a concise understanding.

Given the fast-paced evolution of social media algorithms and virtual communication platforms, studies conducted within the past five years spotlighted the focus of the findings, and priority was given to those that were published within this timeframe. Working with sources across disciplines from communication studies to computer science to sociology to political science provides a multidisciplinary perspective. Priority is given to peer-reviewed journals, conference proceedings and reports of reputable organizations. This ensures that the data analyzed is reliable. Practical examples like algorithms' role in the events surrounding an election or its use in crisis are included as case studies.

Geographically no limit is applied, as echo chambers and polarization are a worldwide phenomenon, although some local features and specifics of virtual communication may find its input but based on regional trends generalisation should be avoided, as a broader view of main interdependencies is needed.

The research is descriptive and analytical. First, it analyzes the functioning and impact of social media algorithms, echo chambers, and polarization, as key findings from the studies reviewed were organized and summarized. Second, a cross-reference of data is used to find the causal linkages. Third, findings from other studies are compared in order to establish differentiations and similarities. The methodology further guarantees that the research meets its objectives in a holistic manner, providing pragmatic insights into the complex relationship between echo chambers, polarization, virtual communication, and social media algorithms through carefully layering evidence from cross-matching sources and considering recent developments.

## Results

The study "Social Media Algorithms and Content Prioritization" (Tang et al. 2023) provides insights on the operation of social media algorithms, with a focus on maximizing user engagement. It describes how algorithms are always improving the information that consumers see based on their past interactions. These loops tend to promote preference reinforcement, in which users receive similar types of content, resulting in what the authors call “content bubbles.” Metrics around post engagement such as likes, shares and comments, are considered by algorithms and the content is ranked and reordered for each user individually. This reduces exposure to opposing viewpoints while guaranteeing that consumers are presented with stuff they wish to interact with. This finding is in line with studies by Ribeiro and colleagues on algorithmic content filtering and the tendency for people to spontaneously interact with like-minded others (Ribeiro et al. 2021). They ultimately argue algorithms exacerbate this polarization by increasing exposure to content that elicits intense emotional arousal, regardless of whether the emotion is one of outrage or moral indignation. This targeted content amplification reinforces extreme positions within ideologically insular communities.

By coining the term PRIME information—Prestigious, Ingroup, Moral, and Emotional—Metzler and Garcia (2023) expand on this selective promotion and make the case that algorithms disproportionately favor content that appeals to social and emotional motivations (Garcia & Metzler 2023). Posts that encourage moral outrage or in-group identity, for instance, are more likely to be pushed since they receive a lot of engagement. As a result, algorithms are more likely to oversaturate feeds with extreme or extreme-to-controversial-seeming information in an effort to achieve maximal PRIME, frequently at the expense of accuracy and representativeness in order to exceed rivals in engagement.

Algorithms prey on cognitive biases (confirmational bias, for example) to keep users engaged. Grinberg et al. investigate the role of algorithms in the algorithmic propagation of misinformation, especially in politically charged events (Grinberg et al. 2019). Their analysis shows that these highly active subjects make up a small minority of users but drive a large majority of misinformation-sharing. Algorithms compound this behavior by prioritizing content that produces intense engagement, regardless of accuracy. They further state that users are more likely to share misinformation that confirms their beliefs, amplifying the reach of that content in algorithmically driven feeds.

It should be noted that there are studies questioning the big impact of echo chambers and algorithms. Duskin et al. reported that the behavior of users often creates echo chambers much more than any algorithm does (Duskin et al. 2024). Algorithms help create network segments, but user choice — the preference to interact with like-minded others — plays a big role in exacerbating these dynamics. Chitra and Musco argue that opaqueness of engaging content algorithmization means that exposure is biased towards polarizing content, but shaping the consumption of information is also crucially the outcome of the network structure and user choice (Chitra & Musco 2019).

In a paper entitled "Avoiding the Echo Chamber about Echo Chambers" (Guess et al. 2018) the authors claim that the prevalence of echo chambers is exaggerated. The authors argue that while selective exposure to ideologically consistent content exists, many users encounter diverse views through weak ties in online networks. They supplement their conclusions with the idea that offline spaces, or where people meet in real life, face-to-face, can be a more politically homogenous spaces than online forums, undermining the widely-held belief that polarization is primarily driven by online echo chambers. While that may be true, virtual communication cannot be ignored. Since different studies indicate that online discussion is more homogeneous than face-to-face (Bode 2016, Pew Research Center 2009) and that relationships like family, friends, work environment and others exert more influence on opinion forming than in the online space, the evidence of the impact of the pace of social media use and digitalization is a more recent phenomenon, therefore only more recent studies should be considered.

In a *Public Opinion Quarterly* 2020 article the relationship between political communication and public opinion is broadly examined. The study emphasizes that both online and offline communications significantly shape public opinion, with digital platforms playing an increasingly prominent role (Edgerly & Thorson 2020). A 2023 study that examines how party affiliation shapes opinion formation within and across online and offline communities identifies potential political biases in both

environments and suggests that communities online may be increasing the potential for such biases because of how content is curated based on algorithms (Ramadhani et al. 2023).

A 2024 study, called "Public Opinion Formation in the Digital Era: Challenges and Opportunities", explores different ways in which digital technologies, particularly social media, have changed the way public opinion is formed. It stresses how the internet has evolved into a predominate means of getting news, enabling spread of information at fast paced speeds, and creating vibrant public conversation. Such changes have affected the dynamics of opinion formation in the political, cultural, and social dimensions (Ramadhani et al. 2024).

Taking these findings into consideration and acknowledging the critique they render on the role of social media algorithms, it once again comes to the interaction between them and users' preferences and the way algorithms work – fostering content that aligns with previous behaviour, they seem to amplify the effect of selective exposure and confirmation bias.

Various studies go into detail on how virtual communication and social media algorithms are correlated and highlight how algorithms are set up to make users more engaged. Making a holistic conclusion on how digital technologies and social media algorithms mediate virtual communication, Katthy Mills and Alinta Brown reach the same conclusion. They discover social media algorithms become incentivized to promote the most engagement-driven content, which is often emotionally incendiary and divisive (Brown & Mills 2021). Virtual reality can bring a whole new level of user interaction and experience to social media. Personalized content delivery has both beneficial (relevance) and detrimental (bias reinforcement) effects on communication dynamics. PRIME features are content that trigger algorithms based on such biases, which is one of the main reasons why algorithms amplify content that aligns with the outlined PRIME criteria (Garcia & Metzler 2023). Social media algorithms significantly influence virtual communication by prioritizing content based on engagement metrics like likes, shares, and time spent (Sundar et al. 2022). In a 2023 study Jacob and Banisch challenged this concept by simulating virtual worlds and showed that strong ideological polarization is exacerbated by algorithmic curation tailored to users' preference-based echo chambers, which develop more forcefully in networks with algorithms that optimize for user engagement. By amplifying strong emotional content (outrage, moral indigation), algorithms become a major driver of polarization through their power to segment groups (Banisch & Jacob 2023). Feedback loops of ever-improving content recommendations driven by user engagement reinforce and aggravate echo chambers, leading to increased ideological segregation.

## Conclusion and Discussions

While some researches of echo chambers and polarization analysis imply echo chambers foster polarization or polarization is the reason for echo chambers to form, recent studies show that there is not a straightforward connection that can be drawn from there processes. Echo chambers and polarization rely on people's homophily,

confirmation bias and selective exposure. They are dependent on virtual communication both as a ground and as means for their existence. Social media algorithms are in place to present online users information and content aligning with their opinions, likes and beliefs. People are generally polarized based on partisan sorting and opposing party platforms especially during politically charged event like elections. In terms of virtual communication, they have a manner to surround themselves with like-minded individuals and to interpret information in a manner that reinforces their believes and viewpoints, leading to greater engagement to content that meets those ends. Social algorithms leverage this phenomenon and expose users to content that will further amplify already existing polarization and the echoes formed within echo chambers. Echo chambers are not simply a byproduct of social media algorithms, but of user preference for information that reinforces their opinions.

The general conclusion of this research is that algorithms contribute to the formation of echo chambers by reinforcing existing beliefs and filtering out opposing viewpoints with virtual communication being a prerequisite for echo chambers formation. That leaves users in ideological silos with little opportunity for meaningful cross-group communication. Another conclusion is that polarization itself is both a cause and effect of algorithmic amplification, and how that amplification shapes effect of virtual communication. Rather than settling group divides, algorithms promote extreme or emotionally charged content, making compromise and conversation harder. It cannot be argued that echo chambers are the sole reason for political polarization or the other way around. It could be concluded that political polarization is based on partisan sorting and performed in echo chambers by virtual communication as mutually dependent phenomena determined exclusively as a result of social algorithms activity.

As mechanisms, algorithms do not operate in a vacuum but are correlated with user behavior and the structures of the networks they influence, meaning that modern society faces new challenges if they wish to address the increasingly polarized climate. All this requires a complex and multi-dimensional effort that should embrace algorithmic changes, media literacy, self-awareness and more academic and fieldwork to keep analyzing and understanding the subtle interplay between virtual communication and algorithms and the consequences on the formation of echo chambers and polarization.

Social media have immense commercial interests and it has been rather difficult to regulate them at the state or union level. The 2024 Digital Services Act of the European Union is a step forward though it focuses more on content and users' moderation rather than the function of algorithms as they have always been and still remain non-transparent. It would be difficult to enforce transparency regulation on social media, but for improved engagement on the Internet and to provide users more control over their communication in virtual environments, transparency in the algorithms is a must (Meier & Reimer 2022). Designs for future algorithms should ensure that engagement does not come at the expense of accuracy and inclusivity, while still promoting constructive dialogues (Mills & Brown 2021). Recommendation systems also need to contain mechanisms for promoting diverse content, emerging from seeing it as a way of counterbalancing echo chambers by algorithms that favour diverse points of view, and thus also reduce segmentation in virtual

communities. Designing such systems is important, but it will not be an easy task to balance user engagement with the need to promote diverse and accurate information.

Media literacy is increasingly recognized in academic literature as a critical long-term intervention for addressing polarization, particularly in digital environments dominated by algorithmic content curation. Defined as the ability to access, analyze, evaluate, and produce media with critical awareness, media literacy enables individuals to recognize the influence of algorithms and their own cognitive biases (Mihailidis & Viotty 2017). Empirical evidence confirms that individuals with higher media and digital literacy are significantly more capable of distinguishing between credible and misleading information, thus reducing susceptibility to conspiracy theories and hyper-partisan content (Guess et al. 2020, Kozyreva et al. 2022). A meta-analysis covering four decades of interventions found that media literacy programs consistently improved critical thinking and skepticism toward misinformation, especially when implemented over multiple sessions (Jeong et al. 2012). This skill development plays a preventative role in mitigating the spread of polarizing narratives. Other studies demonstrate that structured media literacy education, such as semester-long university courses, can enhance students' willingness to engage with opposing viewpoints and reduce the acceptance of one-sided narratives (Ashley et al. 2013). Although direct evidence connecting media literacy to changes in voting behavior or intergroup attitudes remains limited, early results suggest a positive indirect effect on reducing polarization (McDougall et al. 2021).

Digital literacy is necessary to use this digital space more consciously. This is, in addition to basic digital skills, comprehending how algorithms work, and self-exposing to contradictory content firstly – sharing different perspectives and points of view and secondly – educating algorithms that diverse content is desirable. In addition, social platforms themselves could give users more control of their feeds (more than they do) to prevent polarization and increase inclusivity without sacrificing relevance. The gradual evolution of digitalization presents a collective challenge, requiring coordinated societal efforts to mitigate its polarizing effects. Without prejudice to artificial intelligence, human agency should be integrated in order to counterbalance the user-engagement driven logic of algorithms and to cultivate informed, diverse and inclusive virtual communication ecosystems.

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