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Möller, J.

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FILTER BUBBLES AND DIGITAL ECHO CHAMBERS[1]

Judith Möller

Are filter bubbles and echo chambers two names for the same phenomenon?

Filter bubbles and echo chambers are often named as key drivers of political polarisation and societal fragmentation (Pariser 2011; Sunstein 2001). Both concepts are based on the notion that people are excluded from information that is different from what they already believe. Very often, they refer to a partisan divide in ideological camps. The core argument here is that individuals on the political left are exclusively exposed to information that is leaning to the ideological left, and the same is true for those who identify as politically right. Inherent in the concepts is a notion of strong effects of information and technology. Both Sunstein (2001) and Pariser (2011) argue that it is due to the biased information environment that people lose sight of different perspectives and topics, which leads to increased polarisation across partisan lines, decreasing tolerance and understanding of minorities and resulting in a public debate that becomes ever more fragmented (Zuiderveen-Borgesius et al. 2016). Some commentators even explain the surprise outcomes of the 2016 presidential election and the Brexit referendum as direct results of echo chambers and filter bubbles (Groshek and Koc-Michalska 2017).

The original meaning of the term *echo chamber* refers to hollow enclosures used to create reverberation of sound: for example, in churches, cathedrals, and recording studios. Sunstein (2001) introduced the term to describe enclosed spaces of communication. Originally, he directly linked the concept to the presence of filtering systems online, inspired by Negroponte's (1996) idea of the 'daily me'. Yet, in the meantime, the concept has become popular to describe fragmented and isolated audiences in general. As Dubois and Blank put it, 'The idea of an "echo chamber" in politics is a metaphorical way to describe a situation where only certain ideas, information and beliefs are shared. . . . People inside this setting will only encounter things they already agree with' (2018: 729).

The term *filter bubble* was coined by internet activist Eli Pariser (2011) nearly a decade later. He describes a filter bubble as a 'personal ecosystem of information that's been catered by these algorithms to who they think you are'.[2] Like the echo chamber, the filter bubble is defined as an enclosed space, but whereas the metaphor of the echo chamber focuses on the nature of what is inside this space, the metaphor of the filter bubbles emphasises what constitutes its boundaries: the filtering algorithms. It is important to note that both concepts describe a state

rather than a process. Individuals are already excluded from challenging information, yet both arguments imply that the isolation from information that is counter-attitudinal happens gradually over time.

The conceptualisation of echo chambers and filter bubbles and their relationship is still subject to an ongoing academic debate (see, for example, Bruns 2019). However, a consensus on some of the key differentiating characteristics is slowly emerging. First, they can be distinguished by the argument of why people are excluded from counter-attitudinal information. For echo chambers the agency of the selection lies with humans: either a person is self-selecting an information diet that is a perpetual echo of their own thoughts (Stroud 2010), or the social network of an individual spreads primarily information that is in consonance with the belief system and norms of that group (Dubois and Blank 2018). In the original filter bubble argument, the agency lies with the algorithms employed to select information for online news feeds. Following the filter bubble argument, these algorithms are detecting user preferences in an opaque and unobtrusive way and subsequently offer users more of the same content. Inherit in this argument is that this a strong sense of technological determinism. It is important to note that filter bubbles can distort the perception of public opinion. The neutral architecture of online news feeds might create the impression that users see the same content as everybody else while they are really receiving a highly personalised and biased news feed (Zuiderveen-Borgesius et al. 2016).

The underlying mechanism

The reason individuals are exclusively exposed to information that does not challenge their belief system is rooted in the same social-psychological mechanisms for both concepts: selective exposure and homophily. Selective exposure theory suggests that individuals prefer to expose themselves to content that confirms their belief systems because dissonant information can cause cognitive stress they would rather avoid (Festinger 1957). This process is also often called confirmation bias and has been studied and discussed extensively in social psychology and beyond (Oswald and Grosjean 2004). Homophily suggests that we are attracted to others who are similar to us, online and offline. Shared norms, ideology, and ideas are among the most important characteristics when forming relationships (Lazarsfeld and Merton 1954). That means we are frequently talking to others who are likely to agree with us. Our like-minded friends are likely to introduce us to new information that is aligned with shared perspectives and interests. Hence, both mechanisms, selective exposure and homophily, suggest that individuals are motivated to surround themselves with information that aligns with their belief systems while avoiding dissonant information (Stroud 2010).

In fact, we saw such an alignment of political ideology and information environment in the beginning of the twentieth century. During this time, most European citizens were clearly segmented in groups like the working class, liberals, or the Catholics in their respective countries (for example, pillarisation in the Netherlands; Steininger 1977). Back then, group members were associating primarily with each other and consulting only dedicated newspapers and broadcasting stations. Over the past decades, this clear segmentation of the population has become much less pronounced. Today, partisans still prefer news outlets that are aligned with their belief systems but generally no longer avoid counter-attitudinal information (Weeks, Ksiazek, and Holbert 2016). Yet to this day, this kind of political parallelism (Hallin and Mancini 2004) can be observed in many European countries. Hence, the observation that we surround ourselves with voices that agree with us is nothing new or inherently connected to the emergence of the internet. The larger question that Sunstein (2001) in particular has put forward is

whether the affordances of online communication amplify those tendencies. On the theoretical level, the two concepts, echo chambers and filter bubbles, differ in this point.

For echo chambers, the constituting affordances of online communication mainly pertain to online social networks. Sunstein argued that the possibility of engaging in online communities and easily sharing information causes increased fragmentation of the public debate as 'unsought, unanticipated and even unwanted exposure to diverse topics, people, and ideas' is not afforded in the 'gated communities' online (Sunstein 2001: 2). For the filter bubble, the technical affordances are more complex. Algorithmic filtering is a process in which content is sorted and prioritised by certain principles to optimise specific key performance indicators (KPIs). The sorting principles are often a combination of different algorithms: for example, collaborative filtering or content-based filtering (Bozdag 2013). To sort all available information to fill a personalised news feed using collaborative filtering, the recommender engine compares user signals such as past behaviour or location with other users and recommends new content these other users have engaged with. A content-based filtering algorithm identifies content in the pool that shares content characteristics with the content a user already engaged with. Both these principles imply that if a user has a clear preference, this preference is likely to be amplified to increase the likelihood that the user clicks on the content: that is, if it is true that all users prefer content that is an echo of their thoughts. The majority of empirical evidence so far, however, points in a different direction.

Empirical inquiry into filter bubbles and echo chambers

According to a range of empirical studies, users of online information seek out diverse information. This is associated with less rather than more political polarisation. Empirical evidence stemming from large-scale panel studies demonstrates that social networks of users online are often quite diverse, which leads to engagement with a larger variety of news sources (Beam et al. 2018; Beam, Hutchens, and Hmielowski 2018). This finding is in line with a comparative study by Fletcher and Nielsen (2018) in Italy, Australia, the UK, and the US, which finds that social media users who are incidentally exposed to news consult a wider range of sources than those who do not use social media, based on self-reports collected as part of the Reuters Digital News Survey. Recent work by Yang and colleagues (2020), based on a combination of digital tracking data and survey data collected over a five-year time frame, demonstrates that exposure to cross-cutting information even exceeds self-reported exposure to diverse sources.

These large-scale, multi-platform studies all show that the prevalence of filter bubble and echo chamber effects among the majority of the population is low. However, as most of those studies are based on self-reported media use measures, they cannot distinguish whether this is a consequence of social curation and self-selection (echo chamber) or a result of an algorithmic filter system (filter bubble). Even if they are combined with digital trace data of clicks outside social media (Yang et al. 2020), it is still unclear how diverse the news feed that was offered to an individual user was. Therefore, in the following, studies that focus on the different technical affordances of echo chambers and filter bubbles are discussed.

Echo chambers

Several studies focus specifically on the influence of network composition without an additional layer of algorithmic filtering. The 'gated communities' that are core to the echo chamber argument were famously illustrated by Adamic and Glance (2005) based on interlinkage analysis of political bloggers in the 2004 presidential election. They find a clear division of the red and

the blue blogosphere, although both spheres remained connected. These findings were later replicated for political hashtag communities on Twitter (Williams et al. 2015; Garimella et al. 2018). The division along partisan lines online, characteristic of the US political systems, can be understood as an extension of the polarised media system offline. Combining online and offline data, Stroud showed that partisanship predicts the kind of a media diet people follow offline as well as online (2010). This finding is important to keep in mind when thinking about the potential effects of echo chambers because they illustrate two points: first, individual preferences as an expression of interests and political leaning are among the most important determinants of news selection; second, in order to assess whether individuals are locked in echo chambers and excluded from anything but the reverberance of their own thoughts, information intake needs to be studied across all sources. For example, Vaccari and colleagues (2016) find that the structure of offline discussion networks reflects their discussion networks online; those who prefer to discuss politics with those supporting their positions often do so online and offline.

It should be noted that, while it is not necessary that the members of online echo chambers have personal relationships, they matter when it comes to news selection. Anspach (2017) found in a survey experiment in a small student sample that recommendations by friends and family positively influence the likelihood of engaging with the items, even if they are counter-attitudinal.

Filter bubbles

Studying the difference between social curation and algorithmic filtering is notoriously difficult (Kitchin 2017). First, the algorithms employed by social media companies are considered trade secrets. That means the algorithms that are supposedly constructing filter bubbles are beyond reach for academic inquiry (Bruns 2019). Studying automatically scraped user timelines to accurately and reliably measure exposure to diverse information online is currently also considered a violation of the terms of service of these platforms (Walker, Mercea, and Bastos 2019). Moreover, social curation and algorithmic curation are inherently connected and part of a larger system that shapes news curation (Thorson et al. 2019). Hence, a research design that is able to combine detailed news exposure and news consumption, both online and offline, as would be required to understand whether it was an algorithm, social curation, or self-selection that potentially limited a users' access to diverse information, is currently not possible. Having said this, there are a number of studies that can shed light on certain aspects of the process, although they are often limited to one platform or lack external validity because they are based on in vitro experiments that emulate social media news feeds.

There are a number of studies that investigated the effect of algorithmic filter systems on singular platforms: for example Facebook (Bakshy, Messing, and Adamic 2015), Google and Google news (Haim, Graefe, and Brosius 2018; Puschmann 2019; Nechushtai and Lewis 2019), or a news website (Möller et al. 2018). These studies focus on specific affordances that influence the process of algorithmic filtering. For example, Bashky and colleagues (2015) studied the effect of ideological homophily in friend networks compared to algorithmic filtering. They found that the composition of the network reduces the chance of being exposed to cross-cutting content, in particular for conservatives, to a much higher degree than the algorithmic sorting. For Google searches, Haim, Graefe, and Brosius (2018) used a method of agent-based testing to assess whether variation in the signals used for algorithmic filtering affected the diversity of the results in Germany. They found that in contrast to the usage of search terms, the algorithmic selection did not reduce the diversity of the results. In line with this finding, Puschmann reported a high overlap in search results for equal search terms related to politics

in donated data from 4,379 users. Nechushtai and Lewis (2019) came to a similar conclusion for Google News in the US context. Focusing on differences in specific algorithms used, we found that the diversity of algorithmic selection can be even higher than the diversity of human editorial choice for a news website in the Netherlands (Moeller et al. 2016). It should be noted, however, that it mattered how the algorithm was designed. Content-based filters did reduce the diversity in topics while collaborative filtering did not. Collectively these studies indicate that the potential of algorithmic filter systems to exclude users from information that might challenge their extant belief systems has not been realised.

However, should this change in the future, it could lead to increased polarisation. In an experiment focused on the effects of biased, personalised news feeds, Dylko and colleagues (2017) presented 93 university students with personalisation technology with varying possibilities to exercise control. They found that if participants were presented with fewer counter-attitudinal items, it resulted in less engagement with those items. If the participants customised the news feeds themselves, the selective engagement with news was still present, although less pronounced. This implies that even though algorithmic filter systems might not actively reduce diversity through the automatic selection, their user interfaces influence selective exposure.

Bubbles at the fringes

While most research indicates that the specific affordances of online communication do not contribute to the formation of echo chambers and filter bubbles among the majority of the population, several studies suggest that these affordances matter for small-scale bubbles at the fringes of the mainstream. For example, Quattrociocchi, Scala, and Sunstein (2016) studied the emergence of conspiracy-related and science-related bubbles on Facebook, focusing on 1,105 Facebook group pages in Italy and the US. They found that highly engaged users in these communities interacted primarily with those sharing their beliefs and actively sought out information in accordance with their belief systems. Smith and Graham (2019) came to a similar conclusion studying anti-vaccination networks on Facebook. They note that while the movement itself is global, the network among them is dense, and sub-networks appear to be 'small worlds', shielded from counter-attitudinal information.

Conclusion and future directions

All in all, it seems that there is a mismatch between the strong theoretical assumptions of filter bubbles and echo chambers and their empirical manifestations. It is not wrong that people seek out information that confirms their attitudes and beliefs, but they do so online and offline. If anything, the reality of social media and algorithmic filter systems today seems to be that they inject diversity rather than reducing it. A notable exception to this conclusion are highly polarised or radicalised individuals who seek out online communities to connect with like-minded users on a global level. Does that mean we should stop researching echo chambers and filter bubbles? To some extent the answer is yes. As Helberger (2019) and Bruns (2019) point out, the imaginary of filter bubbles distracts from a different, more important discourse on how intermediaries and platforms shape information ecologies. However, the lack of large effects at the moment does not mean that these cannot occur in the future. It is not clear yet whether the formation of fringe bubbles is an exception to the rule or a harbinger of a larger development (Benkler, Faris, and Roberts 2018). From this perspective, there are several avenues for future research.

Towards a spiral of noise

First, we need to gain a better understanding of how choice architecture afforded by social media biases the perception of public opinion (Wojcieszak 2011; Wojcieszak and Price 2009), especially in cloistered online information environments in which users with radical viewpoints feel surrounded by like-minded peers (Schulz and Roessler 2012). Experiencing a virtual majority on a specific platform agreeing with fringe bubble inhabitants could bolster their confidence to reach outside the bubble. As citizens who inhabit fringe bubbles grow more vocal, their favoured issues seep into the general public sphere.

It can be argued that ideas and attitudes expressed in fringe bubbles hold higher news value because of their novelty and extremity (Harcup and O'Neill 2017). This means that once they have overcome a critical threshold, their issues start to gain visibility in legacy media. In this final step, formerly marginalised issues are amplified in public far beyond their support in the population, which in turn can affect the broader climate of opinion (Benkler et al. 2018). Accordingly, we should observe that the spiral of silence (Noelle–Neumann 1974) is essentially reversed. Rather than being muted, fringe voices are amplified into a spiral of noise.

New vulnerabilities

Second, several recent studies (Thorson et al. 2019; Kümpel 2020; Möller et al. 2019) indicate that media use on social media and through algorithmic filter systems creates new digital inequalities. Hence, the most important echo chamber might not be a left- or right-leaning chamber, but a chamber of those interested in current affairs and politics while others are excluded from much of this information. Through automatic profiling and collaborative filtering, those who are already engaged with politics are likely to see more of that, creating substantial knowledge gaps among those who do not. This is especially concerning since this is also the group of people most vulnerable to attempts to be strategically persuaded through tailored, personalised strategic (dis)information (Zuiderveen Borgesius et al. 2018).

A broader conception of diversity

Third, in the review of literature on filter bubbles and echo chambers, it became clear that both concepts are frequently operationalised as ideological bubbles. The notion of diversity is thus reduced to sorting into exactly two political camps: the liberals and the conservatives. While this is an important question, in particular in electoral systems that favour a two-party system, it falls short in accounting for the multi-faceted role information diversity plays in democratic societies (Helberger 2019). For example, the structure of social networks can contribute to communities around certain topics (Bruns, Burgess, and Highfield 2014; Moeller et al. 2016). So far, very little is known about how these issue publics afforded by social media affect the processes of agenda-setting and the formation of public opinion. Similarly, there is a gap in research on diversity in journalistic genre and style users of social media and algorithmic filter systems encounter. In the future we need to learn more about the informational quality of items exchanged in online communities or prioritised by algorithms for individual users. Do these present a mix of long and short formats, opinion and factual reporting? Do they together give an accurate reflection of the diversity in arguments and actors involved in a specific issue?

Finally, the mismatch of theoretical work and empirical work on echo chambers and filters bubbles might also be a manifestation of a lack of explicit normative research in the field. As the impact of technology on opinion formation and political behaviour is either dreaded or not,

the concepts are evaluated from an implicit normative framework about how democracy is supposed to be. To move forward, we need to make this discussion explicit and develop answers to the question of which role social networks and filtering technology should play. This might lead to a more useful answer to the question of whether or the role these technologies are playing at the moment is problematic or not.

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2 As quoted in an interview with Lynn Parramore in *The Atlantic*. Accessed at www.theatlantic.com/daily-dish/archive/2010/10/the-filter-bubble/181427 (28 April 2020).

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