How Social Media's Personalized Algorithms Contribute to Political Polarization

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Abstract

The use of personalized algorithms in social media increases the presence of bias and limitations into the type of content and network that users interact with on a daily basis. These features of social media algorithms have contributed to the increased political polarization in the United States, and this paper will analyze research studies on Facebook and TikTok to evaluate its full impact on society. The framework of co-production, as described by Sheila Jasanoff, will be used to explore the relationship between society and personalized algorithms to analyze the effects of this technology during recent political events. This paper will mainly explore the effects of social media algorithms on political communication in the United States in order to focus more on the increased role of social media during recent political events.

Introduction

With around 72% of Americans active on social media, the personalized algorithms behind their content feeds are becoming more influential on what and who users interact with, especially in today's increasingly polarized political climate (Pew Research Center, 2021). Recently, 18% of U.S. adults reported social media as their main source of political and election news, compared to the 25% that depend on news websites and apps (Mitchell et al., 2020). With social media increasingly dominating the role of traditional media outlets as a major source of news and information, there is also growing concern that personalized algorithms are mainly repeatedly exposing users to posts that line up with their beliefs and ideologies (Levy, 2021). Although social media algorithms can help curate interesting content conveniently, it aggregates user preferences which has made it difficult for Americans to have a common understanding and perception of the political climate (Yudkin et al., 2019). Simultaneously with the increased

dependence on social media, political polarization has been reaching its heights with increasingly deepening disagreements and perception gaps between the two major U.S. political parties, especially with the 2020 Presidential Election (Dimock & Wike, 2020). Political polarization can be defined as the extent of differences in values, ideologies, and other opinions between those in political parties ("Explainer: Political polarization,", n.d.). I had personally first realized this increase in political polarization during the 2020 Presidential Election when it was a much closer race than what I had expected based on what I'd learned from my social media feeds. This phenomena had motivated me to research in depth just how social media algorithms have contributed to the divided political climate here today.

Methodology

This STS Research paper aims to explore the interactions between political polarization and social media algorithms primarily in the United States. This limitation will allow more focus on the uniquely extensive use of social media in recent presidential elections that really highlighted the U.S. 's historic cultural, racial, and regional divides. Research methods will involve analyzing journals and case studies on the effect of user interactions with personalized algorithms and platform actions from Facebook and TikTok. Through these examples of political communication, Sheila Jasanoff's framework of co-production will be applied to further understand how this algorithm technology and society essentially collaborate in increasing political polarization.

Jasanoff defines co-production as how society and technology essentially work to develop each other in a cycle, moving away from the extreme theories of technological determinism and social constructivism that believe the credit is exclusive to either society or technology, not both (Jasanoff, 2004). This framework is about the dynamic interaction between

science, technology, and society so it will be used to analyze how social media's personalized algorithms have interacted with society and its political landscape. Jasanoff believes "...co-production begs for illustration rather than proof" as co-production, along with its practicality and limits, are better shown through empirical studies so this method will be adopted in analyzing political communication on Facebook and TikTok (Jasanoff, 2004).

Jasanoff later uses essays written by various contributors to discuss the co-production framework in more depth but I will mainly focus on Yaron Ezrahi's application of co-production in the context of changes in contemporary democracies. He believes that mass media has helped change the way society acquires political knowledge, depending more on "outformation", a rather diffuse and media-enhanced version of information, because the former is more appealing and accessible to the public (Jasanoff, 2004). "Outformation" requires less effort to produce and consume than information, however this sacrifices the genuinity, objectivity, and accuracy of true scientific knowledge. He also considers information and knowledge to be distinct from one another, as he states:

> Unlike the wise man, the informed person need not be sagacious and his personality may be standardized for the purposes of packing and transmitting information. Unlike the knowledgeable, the merely informed need not make heavy investment in learning. One need not be judicious, wise, inspired or technically sophisticated. Still one must be able to process information. Information is often specifically designed or directed to be used for a purpose.

This conversion of knowledge into information, and then by mass media into "outformation" diminishes intellectual groundedness even more. Ezrahi believes this shift in consumption of knowledge in contemporary democracies is aggravated by personalized algorithms which help

share biased information in a convenient and appealing way (Jasanoff, 2004). My paper will refer to Ezrahi's specific application of co-production when discussing how social media's algorithms affect its role as a key player in mass media and how this has changed political communication. In addition, Jasanoff believes co-production is not only about ideas but also what society values and how people take responsibility for their technological inventions, so this paper will also discuss legal accountability and regulatory limitations. Lastly, the paper will recognize the counter argument that regards human behavior and psychological bias as the main contributor of political divide.

Filter Bubbles and Echo Chambers

The purpose of personalized algorithms is to continuously learn from past user behavior and interactions on the platform in order to provide relevant content that will increase user engagement (Ansgar et al., 2017). However, because these algorithms tend to filter out content and other users that do not match a user's ideology or consumption pattern, this process can effectively isolate users in a filter bubble (Spohr, 2017). These filter bubbles also place users in echo chambers or feedback loops with like-minded individuals, in which people continuously reaffirm existing political beliefs (Spohr, 2017). Rather than open discussion, which is vital to democracy, individual beliefs are constantly echoed back, limiting exposure to opposing views and shaping political attitudes. Despite social media having the ability to allow online content to be more easily accessible, the addition of personalized algorithms in building a user's social network seems to be an obstacle in allowing the consumption of diverse sources of information. Filter bubbles and echo chambers can be seen as an explicit example of co-production between algorithm technology and society. User activity enhances the personalized algorithms which then suggest more interesting content that increases user engagement, producing a cycle of dynamic

interaction between the user and algorithm. Not only does increased user activity improve the personalized algorithms, but the algorithms can also "improve" user experience by making it feel more personal, providing content they will enjoy without the inconvenience of wasting time to go through irrelevant posts. However, because these algorithms work discreetly, they can create an illusion of a distorted reality that is leaning towards their views (Ku et al., 2019).

Although social media platforms have never explicitly released technical details on their highly prized algorithms, there seems to be a general consensus on how exactly these algorithms work. Facebook, for example, has never released data or details on their algorithm but based on a combination of information from the Facebook Papers, public resources, and insider conversations, algorithmic bias seems to be very easily introduced by a user's interactions on their platform (Oremus et al., 2021). In a study on the distribution of online political news articles on Facebook, a proposed solution was successful in ensuring that article recommendations would not lean towards a certain group of users by omitting certain user characteristics from personalization algorithms (Celis et al., 2019). However, the user satisfaction from this reduced content personalization was unable to be measured and the creators discussed significant potential tradeoffs in decreasing user utility, engagement, and company revenue (Celis et al., 2019). As co-production states, society and technology work together to progress one another, and as a result society's values can be reflected in the technology it produces (Jasanoff, 2004). In regards to social media algorithms, it's evident that these algorithms are valuable in gaining and retaining users, and in turn, generating more revenue. With a society that places a lot of value in wealth, it seems unlikely and difficult to see radical corporate-driven improvements in social media's personalized algorithms since it would prioritize equal and fair content distribution over increased revenue.

Increased Perception Gap

Despite the abundance of news sources available online, there has been an increase in the perception gap, the difference between the extent that Republicans and Democrats think they disagree with and what they actually disagree with (Yudkin et al., 2019). Surveys showed that there was a positive relationship between news consumption and the perception gap, meaning that those who consume more news have a more disconnected perception of their opposing political party (Yudkin et al., 2019). Furthermore, Americans overestimated almost twice the proportion of the opposing party that held extreme views and often noted they contributed negative personality characteristics based on their political affiliation (Yudkin et al., 2019). Filter bubbles and echo chambers contribute to this trend as limited exposure to like-minded people can lead to growing intolerance for the opposite political side, often incorrectly demonizing the other side to be more extreme than they actually are (Spohr, 2017). Although social media platforms and their algorithms may not be the likely root cause behind political polarization, given that the phenomena existed well before social media's emergence, many experts believe that they effectively exacerbate partisan animosity (Barrett et al., 2021). A lack of common sources makes it extremely difficult to have a common understanding of the political climate and public opinion, nevertheless opposing party members.

In 2019, Facebook was found to be the most common social media platform where millennials get their political news (Ku et al., 2019). A field experiment observed American Facebook users and to the extent that curated content feeds also involve selectively recommended news articles (Levy, 2021). Users were divided into three groups: liberal, conservative, and a control. After subscribing to media outlets that align with their treatment group, participants' exposure to various news sources were observed. The results showed that

participants visited news outlets if it appeared on their feed despite not matching their ideology due to the convenience, suggesting convenience and accessibility is key to news consumption rather than political ideology (Levy, 2021). This further attributes the diversity of information consumption to algorithm technology, emphasizing personalized algorithms' role in shaping society. The study also found that counter-attitudinal news exposure decreases political polarization but Facebook's algorithm may limit this as participants who were subscribed to outlets that did not line up with their ideology received far fewer posts than those who were in the pro-attitudinal treatment group (Levy, 2021). Lastly, the experiment also showed that engagement was much higher in the pro-attitudinal treatment group, confirming that personalized content increases user engagement (Levy, 2021). Overall, this study indicated that social media platforms have a lot of autonomy and also hold the key in being able to mitigate contributions to political polarization, diversify news, and promote democracy in the exchange of information.

These findings are an example of how the recent shift in consumption of knowledge in contemporary democracies is aggravated by the personalized algorithms that help circulate, share, and discuss biased, opinion-reinforcing outformation in a convenient and appealing manner. These algorithms play an important role in society's increased dependence on "outformation", but as Ezrahi noted, these "outformations" are also preferred because they allow for viewers to connect emotionally with content, unlike traditional knowledge and its scientific commitment to stay logical and repress any psychological elements that distort the perception of our sometimes unappealing and attitude-challenging reality. Ezrahi also suggests this increased role of "outformation" reflects a shift in society in which active participation plays a bigger role in the construction of the political world, where "we can both know and be free in politics" (Jasanoff, 2004). Active political participation involves sharing and discussing political

information, and social media's personalized algorithms have definitely made political news consumption far more convenient, interactive, and accessible than before. Under the framework of co-production, the perception gap could be interpreted as being intensified due to the increased accessibility of pro-attitudinal information (especially "outformation") that allows for more active political participation. As a result, the increased interaction with pro-attitudinal content strengthens the social media algorithms to produce more aligning content, trapping the users in feedback loops and echo chambers, deepening the perception gap. However, this increased participation could be limited to smaller political spheres that align with one's ideologies, rather than the national political setting, and which introduces the next discussion of limited bi-partisan interactions.

Limited Bi-Partisan Communication

Social media's personalized algorithms not only limit exposure to bi-partisan content, but its filter bubbles and echo chambers also limit direct interaction between opposing aisles. Social media platforms are a convenient way to socialize, even anonymously, with large networks of people but content filtering algorithms can be a barrier in diversifying social networks. TikTok is a popular new video-sharing social media platform in which new features of political communication have emerged. Users can not only share videos but also attach background music or sounds, add hashtags, tag users, and even duet other users' posts. All of these features are additional user interactions that are inputted into an algorithm to create a personalized video feed, called the "For you" page. A research study extracted features from thousands of TikTok videos under the #republican and #democrat hashtags to create communication trees in order to investigate how political parties use TikTok for political discussions (Medina Serrano et al., 2020). It was found that the majority of the platform's users are young, and that Republicans

created more videos that also had higher interaction rates (Medina Serrano et al., 2020). However, Republicans duetted pro-attitudinal videos while Democrats were a bit more likely to interact with cross-ideological users (Medina Serrano et al., 2020).

Another team of researchers had also been analyzing political expression on TikTok, as it's become a phenomena as a prominent platform for young activists to interact, unite, and shape their ideologies (Herrman, J., 2020). They had also found that TikTok promotes collective political expression among young users by allowing easier direct communication with like-minded audiences by sharing common symbolic features, such as TikTok audios used for trends (Herrman, J., 2020). Unfortunately, there is very little bi-partisan communication, but a very "polarized discussion of us v. them" (Herrman, J., 2020). Although TikTok does have a "Discover" page, the first thing users see when they open the app is their "For you" page, an endless curated feed of videos. This feature is another example of how social media algorithms entrap users with personalized content in order to increase engagement, but this process results in severely limiting users from a diverse range of users, posts, and information. With convenience as a major motivation for users, especially when using technology, it seems more difficult to change the context and degree that personalized algorithms influence society, or even reverse these consequential impacts of technology.

This is another example of how algorithm technology has allowed for and also reflects how active participation, which in this case is interaction with other TikTok users, plays a more important role in constructing the socio-political climate today. These young users are more likely to interact with like-minded activists because they feel a more personal, emotional connection to them. However, this is concerning because the information they consume on this platform is often given "greater social validity, currency, and political relevance than former

more restricted ones" (Jasanoff, 2004). Oftentimes the perception gap can be seen in TikTok content, as the limited bi-partisan communication on the app leads to inaccurate representations and interpretations of the opposite political side. As a frequent TikTok user myself, during the recent Presidential election I feel that the TikToks I watched often demonized and dehumanized the other political party. Although I did read traditional news articles, the political TikToks I watched often felt more meaningful because they are usually easier to understand, involve personal stories, or even appeal to my humor. Due to this kind of content consumption I had a distorted perception of the current political state. I thought there was no way people like this existed or would agree with their terrible beliefs, nevertheless vote for someone of that image in office. The close 2020 Presidential race was an unpleasant and shocking surprise that really exposed the filter bubbles and echo chambers that social media algorithms have placed many Americans in.

Legal Limitations and Concerns

Co-production is not only about socio-technical collaboration but also society's values and how they take responsibility for their technological innovations (Jasanoff, 2004). As a result, it's vital that we discuss the legal limitations and concerns surrounding the controversial algorithm implementations and data collection methods that invade user privacy. There is a concerning lack of transparency surrounding personalized algorithms and details on their user data collection. Because these algorithms are a relatively new technology, as is social media, there is also a lack of legal policy and industry standards regarding data collection so it's really unclear how exactly user interactions are being used to tune their personalized algorithm (Diakopoulos & Koliska, 2016). Currently there is no uniform federal data privacy law, but a disparate combination of data-specific and few state consumer privacy legislation but a large

majority of data collected is unregulated, allowing companies a large degree of freedom in how they implement their algorithms (Klosowski, 2021). The Federal Trade Commission (FTC) has recently been taking action against tech companies for violating consumer privacy laws as well as mishandling data collection of children (Klosowski, 2021). Unfortunately, the data environments of large platforms are usually complex with spliced and mixed datasets, making it difficult to sort through legitimately and illegitimately sourced data (Wong & Ma, 2022). The FTC has been known to require companies that violate these laws to delete illegitimately sourced data, but when it's difficult to isolate such data, there can be detrimental effects on the algorithm as well as the platform's functionality, making it difficult for people to use (Wong & Ma, 2022).

The current circumstances really leave the distribution of content, the formation of a user's social network, and interactions with other individuals all up to a secretive and complex algorithm technology. This is concerning as society's increased dependence on social media for news places the frequency, type, and quality of their news consumption at the hands of the algorithms behind social media content feeds. In this context, social media algorithms have a significant impact in developing society and shaping its democracy as well. There is an urgent need for society to take responsibility for the consequences of algorithmic technology, not only through technical solutions but also with increased governance from current and new democratic institutions, such as the FTC.

Human Behavior and Psychological Bias

One major opposing argument to the role of personalized algorithms in increased political polarization is that human behavior involves natural tendencies to gravitate towards ideas and people that are similar to them so human psychology is the major contributor of the United States' increased polarization (Spohr, 2017). They also argue that regardless of personalized

algorithms, people naturally gravitate towards information and people that align with their beliefs (Lawrence et al., 2010). These psychological conditions are known as “selective exposure behavior, confirmation bias, and availability bias” (Spohr, 2017). This may be a valid point as political polarization has always been an issue and increasing before the popular adoption of social media (Levy, 2021). However, the rate at which political polarization has increased in the last decade or so is concerning, and social media’s algorithms are a stimulator for political divide. The psychological biases interact with the algorithms to intensify political polarization by increasing a user’s likelihood to cluster in echo chambers with like-minded people. Social media personalization also makes selective news consumption more accessible and convenient. The implementation of these algorithms is also kept very discrete from users as it doesn’t explicitly ask them for their preferences but makes assumptions based on almost all their activity on the platform (Ansgar et al., 2017). As a result, it would be impossible to separate political and cultural dynamics from trends in scientific and technological change. The only proper explanation of societal changes is possible when recognizing “natural and social orders as being produced together” (Jasanoff, 2004).

Conclusion

Personalized algorithms in social media are valuable in helping users navigate through the plethora of content on the web, however they also intensify biases and limitations on democratic political communication. The STS framework of co-production effectively frames the contribution of content filtering algorithms on increased political polarization as these algorithms and political polarization constantly aggravate each other in a cycle, therefore shaping our political climate. The selective distribution of content, including important information such as the news, is concerning as it gives considerable influence over the distribution of information

in society. In addition, the resulting limited bi-partisan communication makes it difficult for democratic discussion and understanding among partisan groups. This social phenomena has grown as a result of the dynamic interaction between technological advancements and an ever-developing society, and as a result we must also take considerable action in taking responsibility by effectively regulating this new technology.

References

Ansgar, K., Perez, V. E., Helena, W., Menisha, P., Sofia, C., Marina, J., & Derek, M. A. (2017). Editorial responsibilities arising from Personalization algorithms. *The ORBIT Journal*, *1*(1), 1–12. https://doi.org/10.29297/orbit.v1i1.26

Barrett, P., Hendrix, J., & Sims, G. (2021, September 24). *How tech platforms fuel U.S. political polarization and what government can do about it*. Brookings. Retrieved December 7, 2021, from https://www.brookings.edu/blog/techtank/2021/09/27/how-tech-platforms-fuel-u-s-political-polarization-and-what-government-can-do-about-it/.

Celis, L. E., Kapoor, S., Salehi, F., & Vishnoi, N. (2019). Controlling polarization in Personalization. *Proceedings of the Conference on Fairness, Accountability, and Transparency*. https://doi.org/10.1145/3287560.3287601

Diakopoulos, N., & Koliska, M. (2016). Algorithmic transparency in the news media. *Digital Journalism*, *5*(7), 809–828. https://doi.org/10.1080/21670811.2016.1208053

Dimock, M., & Wike, R. (2020, November 13). *America is exceptional in the nature of its political divide*. Pew Research Center. Retrieved October 19, 2021, from https://www.pewresearch.org/fact-tank/2020/11/13/america-is-exceptional-in-the-nature-of-its-political-divide/.

Facing History and Ourselves. (n.d.). *Explainer: Political polarization in the United States*. Facing History and Ourselves. Retrieved December 7, 2021, from https://www.facinghistory.org/educator-resources/current-events/explainer/political-polarization-united-states.

Herrman, J. (2020, June 28). TikTok is Shaping Politics. But How? *The New York Times.* https://www.nytimes.com/2020/06/28/style/tiktok-teen-politics-gen-z.html

Jasanoff, S. (Ed.). (2004). *States of knowledge : The co-production of science and the social order*. Taylor & Francis Group.

Klosowski, T. (2021, September 6). *The State of Consumer Data Privacy Laws in the US (and why it matters)*. The New York Times. Retrieved May 3, 2022, from https://www.nytimes.com/wirecutter/blog/state-of-privacy-laws-in-us/

Ku, K. Y. L., Kong, Q., Song, Y., Deng, L., Kang, Y., & Hu, A. (2019). What predicts adolescents' critical thinking about real-life news? the roles of social media news consumption and news media literacy. *Thinking Skills and Creativity*, *33*, 100570. https://doi.org/10.1016/j.tsc.2019.05.004

Levy, R. (2021). Social Media, news consumption, and polarization: Evidence from a field experiment. *American Economic Review*, *111*(3), 831–870. https://doi.org/10.1257/aer.20191777

Medina Serrano, J. C., Papakyriakopoulos, O., & Hegelich, S. (2020). Dancing to the partisan beat: A first analysis of political communication on TikTok. *12th ACM Conference on Web Science*. https://doi.org/10.1145/3394231.3397916

M. Otala, J., Kurtic, G., Grasso, I., Liu, Y., Matthews, J., & Madraki, G. (2021). Political polarization and platform migration: *Companion Proceedings of the Web Conference 2021*. https://doi.org/10.1145/3442442.3452305

Oremus, W., Alcantara, C., Galocha, A., & Merrill, J. B. (2021, October 26). *How facebook shapes your feed*. The Washington Post. Retrieved May 2, 2022, from https://www.washingtonpost.com/technology/interactive/2021/how-facebook-algorithm-works/

Pew Research Center. (2022, January 11). *Demographics of social media users and adoption in the United States*. Pew Research Center: Internet, Science & Tech. Retrieved March 29, 2022, from https://www.pewresearch.org/internet/fact-sheet/social-media/

Reviglio, U., & Agosti, C. (2020). Thinking Outside the Black-Box: The Case for "Algorithmic Sovereignty" in Social Media. *Social Media + Society*, *6*(2), 205630512091561. https://doi.org/10.1177/2056305120915613

Spohr, D. (2017). Fake news and ideological polarization: Filter bubbles and selective exposure on social media. Business Information Review, 34(3), 150–160. https://doi.org/10.1177/0266382117722446

Wong, W., & Ma, A. (2022, March 24). *Destroying personal digital data*. NPR. Retrieved May 3, 2022, from https://www.npr.org/2022/03/24/1088655807/destroying-personal-digital-data

Yudkin, D. A., Hawkins, S., & Dixon, T. (2019, September 14). The Perception Gap: How False Impressions are Pulling Americans Apart. https://doi.org/10.31234/osf.io/r3h5q