

**Investigation of the Political Consequences and Technological Determinism Characteristics
of Content Filtering by TikTok's Algorithm**

A Research Paper submitted to the Department of Engineering and Society

Presented to the Faculty of the School of Engineering and Applied Science
University of Virginia • Charlottesville, Virginia

In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science, School of Engineering

Emily Puleo
Spring, 2021

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

Introduction

Algorithms are widely integrated into technology today, particularly clustering algorithms which show up often in our daily lives. Clustering algorithms are used to help Netflix suggest what other shows you might like or to target online ads to a specific group of people (Netflix.com, 2021; Vachharajani et al, 2019). They can also be used in biological research to group cell populations into distinct clusters (Andrews and Hemberg, 2018). While the technical benefits of these prevalent algorithms have begun to be leveraged, the algorithms' social effects have not been investigated.

TikTok is the fastest growing social media platform in the world, with its success mostly attributed to its “addictive” clustering algorithm that predicts which videos users will enjoy watching to keep users engaged (Asquith, 2020; Fischer, 2020). The app uses clustering concepts similar to Netflix and online advertising to group users based on similar interests and filter viewable content for the cluster accordingly (Fischer, 2020). With the broadening reach of technology, it’s important to consider the societal implications of this platform. It’s critical we understand how this particular technology can impact our society since the algorithm interacts with over 800 million active users and support for the technology is growing exponentially (Mohsin, 2020). This project will examine how the TikTok algorithm is able to make profound impacts on society. The most unique and defining aspect of the algorithm is its unique clustering method which groups users with similar interests into clusters that the technology can target specific videos to base on those interests (Fischer, 2020).

Despite its popularity, the platform and its algorithm have not been studied because it’s only been public since late 2016 (Mohsin, 2020). This project examines the TikTok algorithm in the context of technological determinism and political technology to uncover the relationship that the algorithm has with society and the effects of that relationship. Technological determinism will

be applied to evaluate the extent to which the filtering properties of the algorithm itself contribute to driving changes in society. The concept of political technology will also be used in order to study the driving forces of the algorithm's groupings and examine the bias and political effects of the algorithm's content prioritization decisions. These theories will be used in conjunction because they each examine strictly the non-human origination of technological effects on society and will ultimately address the question: what effect does content filtering in TikTok have on society, and how is this relationship political?

Literature Review

TikTok is a social media platform used primarily by younger people with 41% of users between the ages of 16 and 24 (Mohsin, 2020). Users spend an average of 52 minutes on the technology per day, with 9 out of 10 users frequenting the technology multiple times a day (Mohsin, 2020). When users interact with the social media platform, they interact with the application's built-in algorithm that is able to curate a stream of videos that the algorithm predicts the user will like. The algorithm places users into different groups or clusters and extracts information from user activity, such as time spent watching a particular type of video and likelihood of the user tapping the "like" button on a video (Ton, 2019). The algorithm uses this information to place the user in a group of similar users and then it can use information from the entire group to predict content for one user (Matsakia, 2020). Biases exist within the algorithm as it uses "the collaborative behaviors of a similar user group" to dictate content that is shown to each user (Wang, 2020). This balance between content drawn from a single user's interests and similar users' interests shows that the algorithm is biased in what content is shown to each user since available content is not based solely on the user's expressed interests.

In addition to the inherent biases built into the algorithm, the app is also uniquely structured (Asare, 2020). Unlike other platforms, such as Facebook or Instagram, TikTok does not allow the preferences of friends or followed accounts to affect the content that is intended for the main user. Furthermore, while it is possible to follow specific accounts and indicate preference that way, the app always orients the user to the “for you page” where the algorithm picks the feed, rather than the “follow” page where content is pulled from followed accounts (TikTok.com, 2021). TikTok relies on users and creators to support the app and power its success. Users are people who interact with the app through watching, liking, and sharing videos. Creators are the users who create and post content for other users to consume. Content is any video or collection of videos made by a creator.

To investigate the political implications of the technology, it is necessary to introduce filter bubbles. Filter bubbles, also known as clusters, are a relatively new concept and are an artifact of social media. They “[reinforce] users’ existing preferences” and serve to ensure that social media users are primarily interacting with content that they will enjoy (Fischer, 2020). These bubbles have both positive and negative implications on society. With regards to the success of the platform, users continue to interact with videos and pictures they enjoy and, in turn, continue to use the platform thus creating a cycle of user interaction and platform success. However, studies have shown that these filter bubbles have a polarizing effect on the people entrapped within them. For example, a study by the Laboratory of Computation Social Science examined Facebook pages that shared science and Facebook pages that shared conspiracies. They found polarization between the two groups because people who visited science pages did not interact with conspiracy pages and vice versa. This cycle of entering a filter bubble, becoming polarized, and ultimately becoming part of the group is best summed up when Del Vicario, a scientist involved in the study, shares that

"The more conspiracy articles a person has shared, the more likely they are to share more of these stories and the more likely they are to interact with other people interested in conspiracy theories" (Sumpter, 2018). While filter bubbles and their societal effects have been studied briefly, they have not been studied in the context of TikTok.

Conceptual Frameworks

The social and ethical implications of the TikTok algorithm can be best studied through the lens of technological determinism and the concept of political technology. Technological determinism is a theory which asserts that technology is solely responsible for affecting society and society plays no role in affecting technology in any way. Merrit Roe Smith, an American historian, analyzed the theory and asserts that technology has absolute power over society which provides the foundation for technological determinism (Smith, 1994). This framework will be particularly useful considering that the TikTok algorithm is unsupervised.

The other framework, political technology, will be useful to uncover the social phenomenon associated with the algorithm. The theory emphasizes two ways that technologies can be political. The first states that the process in which the technology is developed will determine the politics of the technology. Alternatively, technology can be inherently political if the technology itself is correlated with specific political relationships (Winner, 1980). The latter idea that the technology itself contributes to political relationships will be used to explore how the technology may or may not distribute power equally among its users.

Methodology

The methods used to gather information for analysis include documentary research and discourse analysis. Documentary research is a systematic approach to analyzing documents for information relevant to the research question. This research will provide context for the TikTok algorithm and give a background on the technology. It will also give more information about the applicable STS theories and how they apply to this field. Additionally, the documentary research will explore the concept of filter bubbles and is expected to establish a connection between the TikTok algorithm and the STS theories. The major limitation of documentary analysis is that “Documents can owe more to the interpretations of the producers of documents than to an objective picture of reality” (Ahmed, 2010). To avoid this, a variety of sources will be collected so that the argument presented is based on a collection of sources rather than a single point of view.

Discourse analysis, the analysis of primary sources from the technology itself, will be especially helpful as it provides a direct link to the technology. Examining TikToks, videos sourced directly from posts on TikTok, will be extremely useful for analyzing the existence of technological determinism and political tendencies in the technology. Discourse analysis will also be applied to other non-academic resources that have information about TikTok. This is useful as the nature of discourse analysis reveals how the technology is able to influence society to where the technology’s effects are being discussed on the news, other social media platforms, and the TikTok platform itself (Asare, 2020; Grant, 2020; Wescott & Liao, 2019). This type of analysis will also be applied to the structure of the TikTok application itself to explore how the mobile application and algorithm work together to create power dynamics and hierarchies. Since limitations of this type of discourse analysis are that online linguistics may affect how the source is perceived and there is only one type of source material available (TikTok videos), this analysis

will be supported by documentary research which pulls from many types of materials, new articles and scholarly papers among them (Androutsopoulos, 2008).

Analysis

TikTok as a Political Technology

To explore the TikTok algorithm as a political technology, it is necessary to address how the algorithm expresses and shapes relationships of power and privilege within the technology. Power in this context is defined as “the ability to connect and share information with anyone on Earth, or with many people simultaneously” and privilege is defined as “relative benefit that a group enjoys as a result of the discrimination or oppression of other groups” (Privilege in the Media). To apply these definitions to TikTok and the communities within TikTok specifically, the groups with the most power and privilege are white creators with traditionally popular content. As of March 9, 2021, the top two most followed accounts are Charli D’Amelio and Addison Rae, both white creators. These creators traditionally make entertainment posts centering on short clips of dances. This content is definitively popular as the most viewed category on TikTok is entertainment and the second most viewed category is dance with over 150 billion views as of January 2021 (“TikTok Statistics – Revenue, Users & Engagement Stats”, 2021). Their power is derived from their extremely high number of views compared to the average creator.

This large sphere of influence of a small number of creators is a direct political artifact of the technology. Power is related to views which contributes to the silencing of other creators by taking away from the potential of their videos to be distributed to users. In simple terms, when a creator has a lot of views it follows that that creator would be in a larger proportion of users’ feeds or filter bubbles as a whole. When certain creators post videos that garner a lot of completed views,

comments, shares, and likes, the algorithm perceives this as a popular video and begins to distribute the video to similar clusters and the popularity and power grows from there as the result of a positive feedback loop (Ton, 2019). Due to this feedback loop, a certain video can be widely distributed and crowd out space where other videos from smaller creators may be popular and appealing to those clusters. This phenomenon of more liked videos getting more exposure is compounded by the fact that when a post has a lot of likes, then people are more likely to physically like it (directly tap the “like” button). If a post already has a lot of likes, then users feel more comfortable also liking the post because people “uncritically approve of positive judgments” (Sumpter, 2018).

The privilege of this elite group of creators is apparent when considering the type of content that is being promoted. Dance content is certainly not important or life-changing information that is critical to be disseminated to a large number of people in the way that creators are currently distributing information. This idea lends itself to a conversation about how the design of the TikTok algorithm, intentionally or unintentionally, empowers certain groups while excluding other groups. The nature of the algorithm is to promote popular content, therefore it empowers groups that are relatable, mainstream, and part of the majority, which excludes minority groups. This concept is illustrated in a recent phenomenon on TikTok where Black creators posting about #BlackLivesMatter posts were seeing a decline in views and engagement with their posts (McCluskey, 2020). While the TikTok administration denied that this was an intentional aspect of the algorithm, many users within the black community reported identical issues. Clearly, if this phenomenon was not a product of algorithm design, it was a product of the algorithm working toward its goal of promoting popular content while silencing a minority group.

These political concepts of power and privilege integrated in the TikTok algorithm are best described in the context of a case study. TikTok creator Feroza Aziz posted a video that began as an ordinary makeup tutorial, but as the TikTok goes on she begins to talk about conflict in China regarding allegations that the Chinese government is placing Uyghur Muslims in concentration camps (Westcott and Liao, 2019). The content of the video is vastly different from the overall image projected from the video. Aziz speaks about the conflict in China while continuing to go through the motions of a makeup tutorial and is able to appeal to a broader audience (Westcott and Liao, 2019). By masking the actual intent of the video, with the makeup video introduction and irrelevant hashtags like #fyp, #foryoupage, #foryou, #4u, Aziz is able to increase her power as a creator because her video is shown to a larger group of users increasing the video's views and likes. She overcomes her inherent disadvantage as a creator of non-popular/mainstream content with this tactic. This method of increasing video engagement by masking content as popularly consumed content is not uncommon and highlights the power gap between creators and demonstrates how creators go to extreme lengths to get their content, arguably more important content than mainstream videos, to be viewed. Some users are manipulating their videos in an effort to transcend the filter bubbles that the algorithm has imposed which highlights that certain users innately have more power and privilege making TikTok a political technology.

Technological Determinism

From a different but complementary perspective, the TikTok algorithm can be viewed as an example of technological determinism where the algorithm itself is driving change in society. As mentioned before, TikTok enacts changes in society through the promotion of certain content.

Selective promotion by the algorithm leads to filter bubbles that trap users into viewing biased content which results in the polarization of users.

In “Algorithmic bias amplifies opinion fragmentation and polarization: A bounded confidence model” by Sirbu, Pedreschi, Giannotti, and Kertesz, the researchers recognize that “flow of information reaching us via the online media platforms is optimized not by the information content or relevance but by popularity and proximity to the target.” This assertion is true for TikTok as well, and the researchers show that “this introduces an algorithmic bias that is believed to enhance fragmentation and polarization of the societal debate.” The study observed pairs of discussion participants and found that randomly chosen pairs will have their opinions move closer together if they are within a set tolerance level. But, if the model is changed to have an increased “probability to choose individuals whose opinions are already close to each other, thus mimicking the behavior of online media which suggest interaction with similar peers,” then opinions become more polarized (Sirbu et al., 2020). This polarization is due to the algorithm inherently creating filter bubbles or echo chambers because the algorithm favors polarization over consensus because polarization leads to increased interaction with the platform. Since the model or algorithm in this study works in the same way as the TikTok algorithm, the study findings can be extrapolated to TikTok and show that the algorithm polarizes a population that is initially divided.

This polarization and biased promotion of content are the societal changes that result from TikTok. Applying the STS theory of technological determinism has uncovered whether these societal changes are driven solely by technology or from other sources like society or a society-technology interaction. For the TikTok algorithm to be an artifact of technological determinism, the societal changes must be a direct result of the technology only. An example of this interaction

it that when users interact with the algorithm their page is shaped only by the algorithm. When users interact with certain content, their “for you page” adjusts to place them into a group/filter bubble that, as mentioned before, will result in the polarization of the users views. If this individual user experience is expanded to all the 1.1 billion active TikTok users, it is possible that societal, not individual, change will occur (“TikTok Statistics – Revenue, Users & Engagement Stats”, 2021). For example, TikTok has made an impact in shaping politics as “TikTok enables collective political expression for youth — that is, it allows them to deliberately connect to a like-minded audience by using shared symbolic resources” (Literat, 2020, as cited in Herrman, 2020). Since “this enables at least the potential for a conversation across political views”, TikTok users enter political filter bubbles and then those political views are imposed on them which in turn shapes the political mindset of TikTok users (Kligler-Vilenchik, 2020, as cited in Herrman, 2020). The part of society that uses TikTok, predominantly Generation Z, will be subject to these filter bubble biases and change as a result.

This potential for societal change is not driven by society, either by the engineers who design the technology or the users who interact with it. It may seem plausible that the designers of the algorithm would be responsible for driving the resulting societal changes, however, the TikTok algorithm is unsupervised (Mohsin, 2020). This means that while the technology took initial building from the engineers, it operates unhindered by any further input. The technology creates filter bubbles and promotes popular content on its own. It may also seem plausible that since TikTok users interact with the algorithm, they may be responsible for shaping their filter bubbles which shape society. However, the users have relatively little power compared to the algorithm. While they are able to like and share content which directs the algorithm on where to place them, once a user is within a filter bubble, it acts as an echo chamber that polarizes the user rather than

gives the user the power to escape since “by optimizing [the algorithm] for personalization and relevance, there is a risk of presenting an increasingly homogenous stream of videos” (Alexander, 2020). Interestingly, this particular algorithm is actually protected from societal input. In most social media algorithms, the algorithm is influenced by the user’s friends or what accounts the user follows but the TikTok algorithm defaults to the curated “for you page” rather than the page that shows followed accounts (TikTok [Mobile Application], 2021). This nuance in the algorithm narrows the scope of what users can view by forcing users to view content from within their filter bubble. Therefore, societal changes cannot be attributed to user input but the technology only because much of user input is disregarded or does not affect the default user page from the algorithm.

Furthermore, the TikTok algorithm cannot be considered as a product of the interaction between society and technology. Since society had a hand in creating the technology, this might be viewed as an interaction between society and technology, but all technology was built by society in some capacity thus invalidating this view. Society is not constantly changing the nature of the algorithm, so society is not interacting with the technology in a meaningful way that changes how the technology operates. Therefore, it’s the TikTok algorithm that’s driving the aforementioned societal changes.

Conclusion

TikTok is a political technology because the algorithm gives more power to creators who make popular content and creates an unequal power distribution between all users. In addition, the algorithm clusters users into distinct filter bubbles that are directly related to the polarization of views. These findings shape the conclusion that by giving some TikTok users more power and

privilege as a result of algorithmic bias, those individuals will have more power over initiating societal change. By placing users into echo chambers, the algorithm imposes views onto users and limits the type of content the user has access to which results in the silencing of minority groups and the promotion of objectively popular content. Further, this idea that the biases of the algorithm are related to shaping the views of society lends itself to the view that the TikTok algorithm is an example of technological determinism. Since the technology itself is creating the bubbles, not by intentional design, the algorithm is shaping society.

As engineers develop technology, they must consider the ethical implications of their work on society. With regards to algorithms, engineers must carefully construct technology in a way that distributes power evenly between users and does not intentionally or unintentionally limit a user's worldview within the platform. If fair power dynamics fail to be effectively constructed within an algorithm then some content overpowers others and, in the case of TikTok, users become polarized. Therefore, engineers are responsible for the societal changes that result from biased technology.

References

- Ahmed, Jashim. "Documentary Research Method: New Dimensions." *Indus Journal of Management & Social Science (IJMSS)* 4 (January 1, 2010): 1–14.
- Alexander, Julia. "TikTok Reveals Some of the Secrets, and Blind Spots, of Its Recommendation Algorithm." *The Verge*, June 18, 2020. <https://www.theverge.com/2020/6/18/21296044/tiktok-for-you-page-algorithm-sides-engagement-data-creators-trends-sounds>.
- Andrews, Tallulah S., and Martin Hemberg. "Identifying Cell Populations with ScRNASeq." *Molecular Aspects of Medicine*, The emerging field of single-cell analysis, 59 (February 1, 2018): 114–22. <https://doi.org/10.1016/j.mam.2017.07.002>.
- Androutsopoulos, Jannis. "Potentials and Limitations of Discourse-Centred Online Ethnography." *Language@Internet* 5, no. 8 (September 4, 2008). <http://www.languageatinternet.org/articles/2008/1610>.
- Asare, Janice Gassam. "Does TikTok Have A Race Problem?" *Forbes*. Accessed October 8, 2020. <https://www.forbes.com/sites/janicegassam/2020/04/14/does-tiktok-have-a-race-problem/>.
- Asquith, James. "Is TikTok Really The Next Big Social Media Platform For Travel," 2020. <https://www.forbes.com/sites/jamesasquith/2020/02/01/is-tiktok-really-the-next-big-social-media-platform-for-travel/>.
- Fischer, Sara. "TikTok Reveals Details of How Its Algorithm Works." *Axios*. Accessed October 8, 2020. <https://www.axios.com/inside-tiktoks-killer-algorithm-52454fb2-6bab-405d-a407-31954ac1cf16.html>.
- Grant, Charity. "Uncovering the TikTok Algorithm and the App's Racial Bias." *The Oarsman* (blog). Accessed October 12, 2020. <https://veniceoarsman.com/10142/uncategorized/uncovering-the-tiktok-algorithm-and-the-apps-racial-bias/>.

Herrman, John. "TikTok Is Shaping Politics. But How? - The New York Times." Accessed April 5, 2021. <https://www.nytimes.com/2020/06/28/style/tiktok-teen-politics-gen-z.html>.

Matsakia, Louise. "How TikTok's 'For You' Algorithm Works | WIRED." Accessed April 4, 2021. <https://www.wired.com/story/tiktok-finally-explains-for-you-algorithm-works/>.

McCluskey, Megan. "Black TikTok Creators Say Their Content Is Being Suppressed | Time." TIME. Accessed April 4, 2021. <https://time.com/5863350/tiktok-black-creators/>.

Mohsin, Maryam. "10 TikTok Statistics That You Need to Know [September 2020]." Accessed October 12, 2020. <https://www.oberlo.com/blog/tiktok-statistics>.

Netflix.com. "How Netflix's Recommendations System Works." Help Center, 2021. <https://help.netflix.com/en/node/100639>.

MediaSmarts. "Privilege in the Media," April 2, 2012. <https://mediasmarts.ca/digital-media-literacy/media-issues/diversity-media/privilege-media>.

Sîrbu, Alina, Dino Pedreschi, Fosca Giannotti, and János Kertész. "Algorithmic Bias Amplifies Opinion Fragmentation and Polarization: A Bounded Confidence Model." *PLOS ONE* 14, no. 3 (March 5, 2019): e0213246. <https://doi.org/10.1371/journal.pone.0213246>.

Smith, M.R. (1994). Technological Determinism in American Culture. *Does Technology Drive History?: The Dilemma of Technological Determinism*. (pp. 1-17). Cambridge, Massachusetts. London, England. The MIT Press.

Sumpter, David. *Outnumbered: From Facebook and Google to Fake News and Filter-Bubbles – The Algorithms That Control Our Lives*, n.d.

Influencer Marketing Hub. "TikTok Statistics - Revenue, Users & Engagement Stats (2021)," January 11, 2019. <https://influencermarketinghub.com/tiktok-stats/>.

TikTok.com. “How TikTok Recommends Videos #ForYou.” Newsroom | TikTok, August 16, 2019.

<https://newsroom.tiktok.com/en-us/how-tiktok-recommends-videos-for-you>.

. “Liking | TikTok Help Center.” Accessed April 4, 2021. <https://support.tiktok.com/en/using-tiktok/exploring-videos/liking>.

Ton, Henry Tien. “How to Crack the TikTok Algorithm to Create Viral Videos | by Henry Hien Ton | Medium.” Accessed April 4, 2021. <https://medium.com/@henryhienton/how-to-crack-the-tiktok-algorithm-to-create-viral-videos-d8a00e38e5ae>.

Vachharajani, Honey, Rajeev Gupta, and Nikhlesh Pathik. “User Clustering Algorithms in Online Advertising.” *International Journal of Recent Technology and Engineering* 8, no. 2S4 (August 27, 2019): 29–35. <https://doi.org/10.35940/ijrte.B1006.0782S419>.

Wang, Catherine. “Why TikTok Made Its User so Obsessive? The AI Algorithm That Got You Hooked.” Medium, June 7, 2020. <https://towardsdatascience.com/why-tiktok-made-its-user-so-obsessive-the-ai-algorithm-that-got-you-hooked-7895bb1ab423>.

Westcott, Ben, and Shannon Liao. “TikTok Beauty Video with a Hidden Anti-China Message Goes Viral - CNN.” CNN. Accessed October 12, 2020. <https://www.cnn.com/2019/11/27/tech/tiktok-xinjiang-eyelash-curling-scli-intl-hnk/index.html>.

Winner, L. (1980). Do Artifacts Have Politics? *Daedalus*, 109(1), 121–136.